VOL. 15. NO. 12 Registered in U. S. Patent Office DECEMBER, 1917

THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED

THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER:

ELECTRO-PLATERS REVIEW.

$1.00 Per Year 99 JOHN STREET, NEW YORK 10 Cents Per Copy

A MONTHLY JOURNAL RELATING TO THE METAL AND PLATING TRADES

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MANUFACTURING EXPENSE

METHODS OF ASCERTAINING AND APPORTIONING THIS ITEM.

WRITTEN FOR THE METAL INDUSTRY BY RALPH H. BUTZ.

ELEMENTS OF COST.

The first element of cost in manufacturing processes is material. Material may be said to be of two classes, direct and indirect. Direct material can be charged to the particular job or order of which it forms a part. Indirect material, frequently called general supplies, is of such a nature that it forms the expense material of some department, not being directly chargeable to any individual job or order.

The second element of cost is labor, and this may also be divided into two classes, direct and indirect, or productive and nonproductive. Direct labor is that which is applied directly to a certain job, and with which the job is charged. Indirect labor is not expended upon any particular job, but is general in its nature, and therefore is charged to the manufacturing expense of the department in which it is used or applied.

It will be seen that the cost of materials added to the cost of direct labor results in the prime cost of the commodity manufactured. To ascertain this prime cost is not a very difficult matter where an efficient cost accounting system is being maintained, as the value of material and labor that enter into a product can be ascertained with a reasonable degree of accuracy.

There is, however, a third element of expense which must be added to the prime cost to ascertain the total cost of manufacture. This third element is manufacturing expense, sometimes called factory expense or overhead. This expense is of such a nature that it cannot be definitely assigned to any particular job or series of jobs at the time that it is incurred, and it is around this item of manufacturing expense that most of the difficulties of the cost accounting system present themselves. While manufacturing expenses do not change the appearance or composition of the article manufactured, they are an intangible cost which it is necessary to incur in order that the plant may be operated at the highest point of efficiency. Therefore, it is necessary that these expenses be distributed proportionately among the articles manufactured, that is, each job must bear its rate of the expense burden incurred, because these expenditures were actually made on account, at least in part, of the commodity made.

Before these expenses can be distributed properly it is necessary to determine just what constitutes manufacturing expense. There are numerous items which may not seem to bear any relation to the processes of manufacture, and which are not directly chargeable to any particular process, and yet are necessary that those processes may be continued.

FIXED CHARGES.

Among the items included in the fixed factory charges is building expense or rent. Where the manufacturer owns the building the expenses consist of insurance, taxes and depreciation. If the building is rented the owner will pay these items, while the manufacturer will pay rent. Such items as light, heat, water and sundry expenses, the manufacturer will pay in either case. When the building is owned by the manufacturer it is advisable to charge interest on the investment, thereby arriving at the amount of expenses for the building. For instance, where a building is rented for ten thousand dollars per annum, it is natural that this amount of rent is a part of manufacturing expense, and is so charged to the materials manufactured. Suppose the manufacturer purchases this building for $100,000, and thereafter charges to manufacturing expenses only the items of insurance, taxes, depreciation and repairs. Under these circumstances his building expense charges will not be more than a small part of what they were previously, but they will not reflect the exact facts, because he did not account for the interest on his investment.

In order that these factory expenses may be distributed equally, it is necessary that the business be departmentalized. Each business can to a certain extent be divided into departments in accordance with the methods and processes of manufacture, and the better this division is made the more accurate will be the results.

The basis for fixed factory charges then will be the number of used or productive square feet, and each department will be charged for the number of productive square feet, times the rate, which will be the amount of the rent expense it must bear.

The distribution of power presents more difficulties. In the majority of plants the power for all the departments is supplied by one central power department, and often the steam for heat is also supplied by the same boilers, thus making the situation more complex. No fixed rules can be made that will apply to a large number of plants, as the power problem of each plant is to be considered in a class by itself. A general plan for this purpose which is used more extensively than any other is to calculate the horsepower required by each department, multiplying this by the average number of hours of operation, thereby developing a unit by which the total power charges can be divided.

Insurance on building and equipment is also considered as a fixed charge and should be distributed accordingly. The insurance on the buildings should be distributed in

the same manner as the rent charges, each department bearing insurance expense in proportion to the amount of productive space occupied. Insurance on equipment should be distributed on the basis of the value of equipment of each department. Thus, if the machinery of one department is valued at $30,000, this department would be charged twice as much insurance as another department, whose machinery is valued at only $15,000. Insurance on boiler and fly-wheel are direct charges to the power department, while workmen's compensation and other forms of liability insurance can not be directly charged to any department, and are, therefore, a charge to general expense.

Depreciation is an item concerning which more has been written than about any other item of expense. It is one of the most important of overhead expenses, and is usually the largest, and yet there are managers and mill owners who cannot understand why depreciation should be charged to manufacturing expense, and thereby increase the cost of manufacture. Depreciation is a real thing. It occurs every day. It is the constant wearing out of those assets known as buildings and equipment. In the process of making a product the plant is being consumed together with the raw materials and the labor, and therefore it is a charge to such articles on whose account it is being consumed. There is no recognized standard method of handling depreciation owing to the fact that each factory has its own peculiarities, and that no two factories are alike. The method in which it is accounted for in different mills varies according to the views of the management, but it is a recognized fact that a system which does not include the charges for depreciation is at best a faulty system, and is not to be relied upon when exact costs are required.

There are certain mill owners who charge depreciation during those years when a good profit has been earned, and when the profits are small, no depreciation charges are made. It would seem that these individuals must have a peculiar method of reasoning to convince themselves that depreciation occurs only when profits are made.

While it is very improbable that a person can estimate the exact life of machinery, or the exact amount of yearly depreciation, the practical manager can make approximate estimates which will be accurate enough for the purpose. The best method is to ascertain the value of machinery in the individual departments and determine the yearly depreciation of each separate class of machinery. A certain manager will estimate the life of a machine at ten years, and to find the annual depreciation charge he will subtract the scrap value of the machine from the original cost, dividing the result by 10, which will be an estimate of the annual shrinkage in value. Another manager may estimate the life of the same machine at 15 years, and charge less yearly depreciation; but he may find that at the end of ten years the machine may be so worn that it can only be operated with a smaller per cent of efficiency, and if it is kept in use during the five-year period as originally estimated, he may find that the loss in decreased production and loss of efficiency has more than exceeded the annual depreciation charge. Under these circumstances he would have used better business judgment if he had scrapped the machine at the end of the ten-year period.

Many factory managers are guilty of underestimating the amount of depreciation in order that they may show low costs of production, only to realize at the end of a number of years that the actual value of the plant is but a small part of the value recorded upon the books.

Each department must bear the amount of depreciation as estimated. These estimates should be made at the beginning of the year and should be distributed as charges to the material manufactured.

It is a common method to reduce the assets each year by charging against them the depreciation and creating no reserve to take care of replacements as they occur. It is more advisable to create a reserve fund with which to purchase machinery when worn out, otherwise a firm may find itself in the curious position of having greatly reduced assets and no fund with which to make replacements. However, no matter what method is used in ascertaining this charge, it is easily apparent that depreciation is a fixed charge and increases the cost of the manufactured commodity.

DEPARTMENTAL GENERAL EXPENSES.

There are a number of smaller items which are charged to the general expense account for each department. Under this heading will come such items as non-productive labor, miscellaneous supplies, oils, renewals and repairs. Of course, care should be taken that each department is properly charged with its proper amount of these items. For instance, non-productive labor used in one department should not be charged to another, which frequently happens through carelessness.

There are certain other variable expenditures which can not be directly charged to any departmental expense account, and these are charged to an account called "General Factory Expense." This account can be distributed over the various departmental accounts upon a basis which will be fairly proportionate.

SALES AND ADMINISTRATION.

The cost of production having been ascertained by the methods described, the selling cost can be found by adding the expenses of the sales department and administration. This percentage is usually determined by estimating the selling and administration expenses for the year, and dividing by the estimated cost of production for the year.

DETERMINATION OF CADMIUM IN BRASS.

The effect of cadmium on brass has been the subject of a good deal of concern among metal users, yet in spite of this very little investigation appears to have been carried out by manufacturers of copper alloys. So far as is known, more than 1 per cent of cadmium in spelter would be detrimental to the manufacture of high-class brasses, particularly those used for cartridge metal or deep drawn stock. On the other hand, it has been shown that less than 1 per cent of cadmium need not be considered as having injurious effects on brass mixture. Cadmium that might remain in the brass and exist as a cadmium-copper alloy or cadmium-zinc-copper alloy, would cause the resulting brass to be brittle, and would not admit of the malleable properties that are required in commercial brass.

As a matter of fact, small amounts of cadmium in brass are extremely difficult to find. A method suggested by Mr. E. Schramm at the spring meeting of the American Chemical Society was first tried on known salt mixtures and then applied to commercial brasses. This method consists of first partly freeing the nitric acid solution of copper by electrolysis, then precipitating out the rest of the copper, the tin, and the lead by the ordinary method, then adding dilute sulphuric acid to the solution and getting the zinc and cadmium into the form of sulphates. The cadmium is then precipitated out by means of hydrogen bisulphide. The cadmium sulphide, after filtering, is then converted into the sulphate by treating with sulphuric acid and reprecipitated as the sulphide by using ammonium poly-sulphide according to Noye's method.

DESIGN VALUE OF DECORATIVE MOTIFS

A Series of Articles on This Interesting Subject Has Been Prepared by the Author With the Object in View of Giving the Student Craftsman in Art Metal Works a Comprehensive Idea of the Design Value of Decorative Motifs, Their Characteristics Peculiar to the Particular Period or Style in Which They Appear and So Far as Possible to Explain Their Origin, Symbolic Significance and Decorative Value. It Is the Author's Sincere Hope That the Series Will Fulfill the Purpose for Whichh It Has Been Prepared—Third Paper.

Written for The Metal Industry by A. F. Saunders, Designer Benedict Manufacturing Company, East Syracuse, N. Y.

PLANT FORMS

The forms of ornament best understood and most admired are those most nearly resembling something in nature a purely abstract-ornamental motif seems beyond the understanding of the average person. Neither its beauty, character nor general fitness to a design of which it may form a part will arouse the same amount of interest or sympathy as will some motif directly identified with nature's flora and fauna.

What does it represent? is a question often directed at some conventional motif used as a decorative unit in a pattern. Of course, when the conventionalization of an object is attempted by the designer, say by way of illustration of flower or leaf, it should not, and will not, if treated properly, lose its general characteristics when reduced or modified into terms of decorative design, generally speaking the term convention is often misunderstood.

In these literal and photographic times one of the first questions which confront the designer is the degree of naturalism which is within his scope and purpose. There are endless ways of looking at nature. We may use our eyes alone, or we may bring into use all of our faculties and not find them too much. It is certain that what we feel and know enter as largely into our art as what we actually see. The designer may make as many careful studies from nature as the painter, but he looks for different facts and expresses them in a far different way.

The pictorial artist would represent what he sees in a more literal manner, placing on his canvas practically what he sees; whereas on the other hand the designer would study it from a different angle, his aim being to make a decoration. He must therefore geometratize and systematize, making a pattern rather than a picture, emphasizing certain facts and making external appearance subservient to the decorative purpose in hand.

The mere drawing of a sprig of foliage or a flower does not constitute design, but to adapt them to a given position and purpose in a relative and harmonious manner to a design as a whole and often the manner of the material of which the design is to be finally executed,

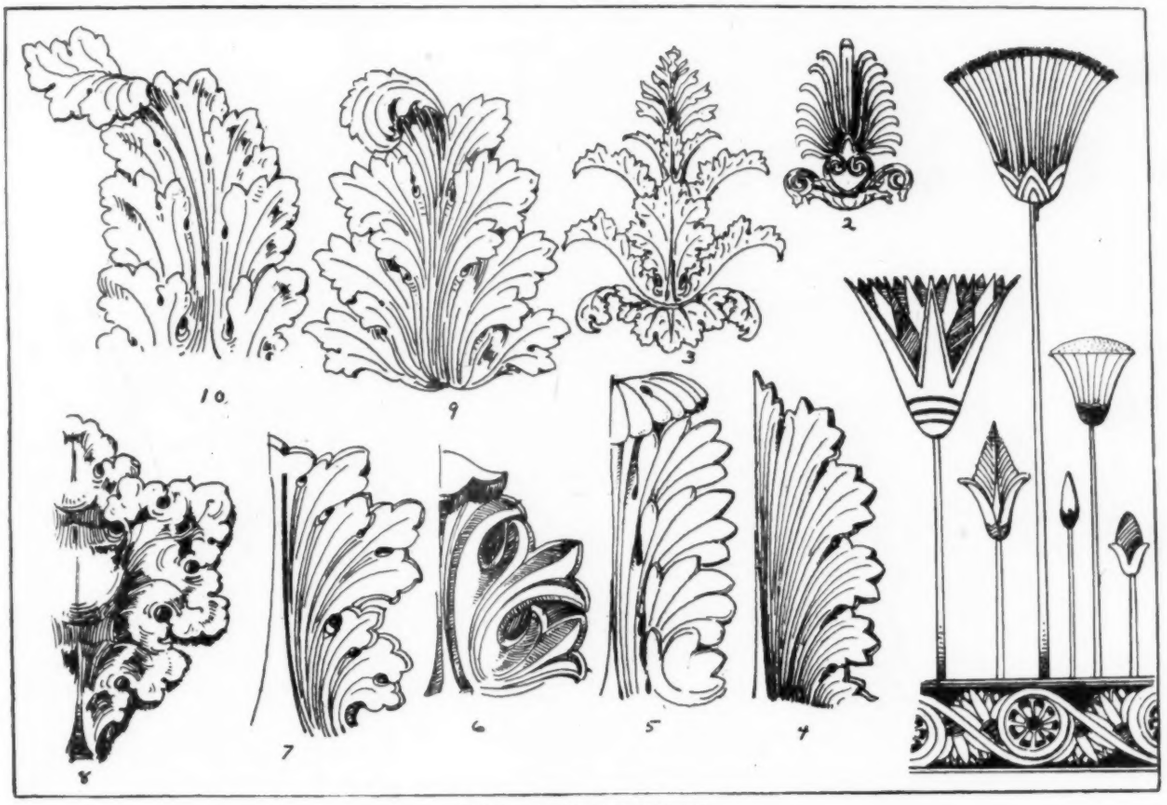

PLATE 5. PLANT MOTIFS.

1. EGYPTIAN DECORATIVE—MOTIFS, PAPYRUS AND LOTUS. 2. GREEK, ANTHEMION OR HONEYSUCKLE MOTIF. 3. ACANTHUS PLANT. 4. GREEK, ACANTHUS MOTIF. 5. ROMAN, ACANTHUS MOTIF. 6. BYZANTINE, ACANTHUS MOTIF. 7. ROMANESQUE, ACANTHUS MOTIF. 8. GOTHIC, ACANTHUS MOTIF. 9. ITALIAN RENAISSANCE, ACANTHUS MOTIF. 10. FRENCH RENAISSANCE, ACANTHUS MOTIF.

requires not only intelligence and training but inborn aptitude as well. Plant life has, from the very beginnings of ornamental art, formed the greatest source of inspiration for decorative motifs. In almost every style plant forms of one kind or another have been used in patterns. Flowers, leaves, fruits and sprays either singly or combined have been adapted in ornament. Can one imagine Egyptian art without the Lotus, Papyrus and Palm? Or Greek ornament without the Acanthus leaf?

One is inspired by the degree of variety in the treatment which a single type may undergo in different hands. It seems safe to say that not in the case of a single plant have the possibilities in the way of decorative treatment and adaptation been exhausted. Take for example the well known "Acanthus." There has not been a single plant that has been more used, or for that matter abused, as a decorative motif. It glorifies the Corinthian capital

PLATE 6—DECORATIVE APPLICATION ON PLANT MOTIFS.
1, CANDLESTICK, IN SILVER OR BRONZE, EGYPTIAN LOTUS; 2, VASE, IN GOLD OR SILVER, EGYPTIAN PAPYRUS; 3, FERNERY, IN BRASS OR BRONZE, EGYPTIAN MOTIF; 4, GOLD PENDANT, EGYPTIAN LOTUS LEAF MOTIF; 5, COFFEE POT, IN SILVER, CLASSIC LINES, ACANTHUS DECORATIVE MOTIF; 6, PARASOL HANDLE, IN SILVER OR GOLD, MODERN TREATMENT OF ACANTHUS; 7, CANDELABRA, IN SILVER OR BRONZE, GREEK ACANTHUS MOTIF.

of Greek architecture. It forms the leading decorative motif in the Roman and Byzantine, and with the meadow rue, bell flower and vine motifs it forms the very backbone of the Gothic style.

The Greeks selected the "Acanthus" not because of any particular symbolic significance, but purely upon its unusually beautiful decorative qualities. They certainly could not have selected any plant form found in nature's wonderful garden that offers greater ornamental possibilities. There are a number of varieties of the Acanthus plant native to southern Europe. Some have broad, blunt tips to the leaves, others have pointed lobes terminating in spines and comparatively narrow leaves. The conception and treatment of the margin and shape of the leaf is the principal characteristic of the different styles (see illustrations, plate 5). In the Greek treatment of the Acanthus leaf it has very sharply pointed edges and the various lines, contrary to nature, taper downwards to the base of the leaf. These lines, together with the central stem, impart a certain richness and dignity to the ornament.

The Romans rounded up the tips of the leaves and the general treatment was broader, the curves more vigorous. In the Byzantine and Romanesque styles a return to the stiffer and less delicate forms is found. In the early Gothic its form is round and bulbous, and in the later period more extended, almost thistle like, in appearance, but it was during the Renaissance with its revival of the antique that the use of the Acanthus as a decorative motif reached its highest degree of development. There is not a phase or period of the Renaissance but what has received inspiration from the flowing lines of this graceful plant.

Another well known decorative motif with the Greeks was the so-called Anthemion or Palmate (see Fig. 2, plate 5). This conventional motif is a fine example of the principle of radiation as applied in design. While it resembles the leaf of the palm, it is questionable if it really received its inspiration from the Palm. It is sometimes called the honeysuckle, but it does not resemble in any way the plant or flower we know by that name. More likely it grew, as one may say, out of the use of the brush. The brush strokes arranging themselves into forms that resemble the radiating lines of the Palm leaf, the same motif treated in a slightly different way forms a decorative unit in both the Assyrian and Egyptian styles of ornament.

Illustration No. 6 shows the decorative application of the Lotus, Papyrus and Acanthus along modern lines.

BRASS FOUNDRY PRACTICE

THE BEST METHOD OF GETTING ACCURATE CASTINGS FROM PATTERNS.

WRITTEN FOR THE METAL INDUSTRY BY P. W. BLAIR, MECHANICAL SUPERINTENDENT.

The best method of procuring accurate castings which are produced in large quantities is to mount the patterns on plates and get away from the old method of using gated patterns or match plates.

A leading brass manufacturer, using 50,000 small castings every six months from gated patterns, did not realize that some of his castings were coming from the foundry at times weighing on an average two ounces more than they should weigh.

This is a small matter when you are running castings in small quantities, or you are selling the castings by weight, but when you are producing these goods and selling them by the dozen in lots it is quite an item in cost owing to the high cost of all kinds of metals that enter into the construction of these castings.

This overweight was caused by rapping the gated patterns in the foundry, which operation is eliminated on plate patterns.

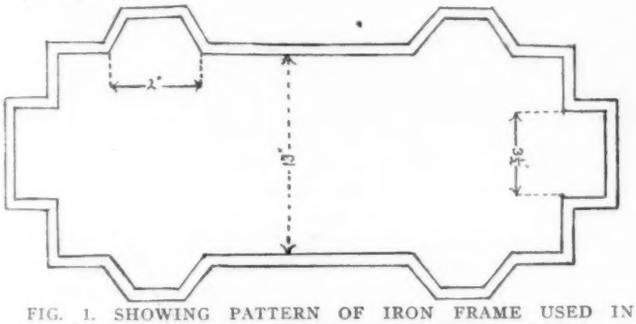

FIG. 1. SHOWING PATTERN OF IRON FRAME USED IN MOLDING CAST ALUMINUM PLATE WHICH, WHEN COMPLETED TO BE USED ON 16 x 11 FLASK.

In making plate patterns it can be often arranged so that more can be used than with gated patterns in a mould, and at the same time poured with the same sprue, which is a great saving, and gives the foundry a chance to cut cost of production. The size of gates can also be reduced on plated patterns, as one large enough to run the castings is all that is required. In gated patterns it is frequently necessary to use heavy gates to support or keep patterns in shape.

There are many ways of mounting patterns on plates. This applies more particularly to small patterns and accurate work that must be true to pattern where the orders are duplicated each month.

To mount patterns on a steel metal plate, especially where each of the patterns is made to draw, that is to say where it is not necessary to split the pattern, they should be tested out loose to find out the best manner to gate to get perfect castings. Having decided the method to be employed, a gate casting is made and finished up to apply on the plate which is then riveted on and patterns located and fastened on plate to match up with gate.

In attaching split patterns to a plate great care must be exercised so that they match up on each side. To insure this the patterns should be sweated together in halves and finished to desired size, drilled for rivet pins and then numbered in pairs to match up accordingly.

The half of each pattern is then laid out on plate and drill pins inserted and the other half matched up and riveted onto plate. The expense of such a plate is considerable as there is a large amount of labor involved, but when completed the life of such a plate of patterns is indefinite.

One of the most satisfactory and most up-to-date methods which has come into use the past few years, is to make aluminum cast pattern plates.

A special molding flash larger in size than the flask that the plate is to be used with is employed. A regular mold is made from the master-patterns and gated allowing for the usual aluminum shrinkage of 3/16 inch per foot. Care is taken to have the parting line very true. An

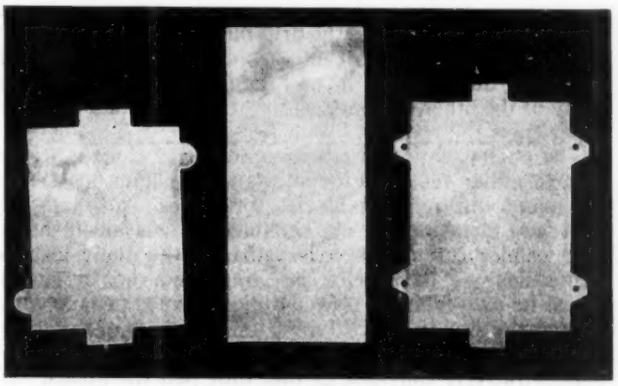

FIG. 2.—STEEL PLATES ¼ INCH THICK USED FOR MOUNTING PATTERN.

iron form (see Fig. 1) is placed in the mold, thickness of plate desired ¼ or 9/32 inch is placed in position to form outside of plate. The recess cavities allow the metal to fill up. Provision should be made for dowel pins on the flask when the plate is in use and for handles on the end for attaching a vibrator and for lifting the plate off and on the flasks. The advantages of a cast aluminum plate are many. It eliminates the danger of the patterns coming loose, the plate is lighter to handle and allows of larger production. The cost of a cast aluminum plate is very low compared to mounting patterns on steel plate. All that an aluminum plate requires is a trimming up, when it is then ready for use. Fig. 2 shows a plate of patterns mounted on steel plate.

SILVER PLATING IN A BARREL

Steel screws are being successfully silver plated by the barrel method. There are barrels on the market that give excellent results.

For a high lustre it might be necessary to steel ball tumble them afterwards for a short time, but with the regular bright silver solution this operation might be avoided.

A solution for the purpose should consist of cyanide of silver, 3 to 4 ounces, cyanide of potassium, 8 to 12 ounces per gallon. Then prepare a brightener by using equal parts of bisulphide of carbon and sulphuric ether, and add this to a concentrated solution of cyanide of potassium.

The following proportions may be used:

Cyanide	8 ounces
Water	1 quart
Bisulphide of carbon	2 ounces
Sulphuric ether	2 ounces

Thoroughly dissolve, then add a teaspoonful to each gallon of solution. If any of the carbon remains undissolved add more cyanide.—C. H. P.

CASTING BEARINGS IN SAND AND METAL MOULDS

A Paper Read at the American Institute of Metals, Boston, Mass., September 24-28, 1917.

By R. R. Clarke, Pennsylvania Railroad Company, Pittsburgh, Pa.

(Concluded from November.)

From the abstract of argument we might go to the concrete of actual foundry experience and search for the corroborating facts. There we find them plain and convincing. We find them in the excessively high head contents of castings poured last from pots of metal not properly stirred; in the sheets of pure lead embroidering the bottoms of castings left in the sand until cold; in the lead-beading surface and the drip-filling pools of lead from castings shaken out hot; in the high-lead pig of metal heated to dull redness in or around the furnace and in many of the other ordinary observations of actual foundry experience.

The object of this discussion admits no attempt whatever to either repudiate or substantiate claims made for the many different auxiliaries, processes or brands of high lead metal on the market today. This much, however, candor compels us to say that of the many instrumentalities we have tried or seen tried, not a single one of its own inherent power came anyways near to controlling the situation. Different times makers of different products have sent representatives to our foundry to demonstratively convince us that they had the goods. It is a matter of regretful, but cold and easily substantiated fact that in every such instance under the expert supervision of the claiming party the failure was utter and absolute.

These statements involve no contradiction of our expressed neutrality of the status of different claims made and are submitted merely to present the situation in a clear light as well as to impress the inexperienced with the folly of relaxing in practice through over confidence in the auxiliary.

Combining molten lead and copper at 50-50 resembles in effect mixing a pint of oil with a pint of water. Agitation will produce a sort of an emulsion, the permanency of which normal conditions quickly destroy. Initial uniformity of lead distribution depends on agitation which can be realized through vigorous stirring while to perpetuate this condition presupposes a continuation of the initiating process. We have often felt that makers of high-lead brands of mixes ought to emulate the medical men and label their goods "shake well before using." Incidentally we could court no pleasure more sincere than to meet the man who can simply drop his lead into the copper-tin-auxiliary bath, or his lead-auxiliary into the copper tin bath, hurry off to his mold and pour his casting with perfect results attending. We are sort of hoping this fellow might bob up at the convention.

Undoubtedly, so far at least as our experience can be said to cover the case, the logical order it to regard the auxiliary strictly as an auxiliary, a mere helping influence which can no more produce unaided by critical practice than critical practice can yield returns unaided by it. Plainly stated our impression is that the two are essentially interdependent in practice regardless of claims experimentally established in behalf of any one with which we are familiar.

In the main manipulative practice in high lead coincides with that applying to the low and the conservative, it varying in a few details only. The inclusion of phosphorus either by intent or accidental contamination is prohibitive, the use of low-grade material is more markedly detrimental, the consequence of melting over and over becomes more serious, and the constant building up of scrap with new material the more imperative. Pouring temperature is more critical in that oxidation is the more intense forcing temperature to that happy medium whereat the metal will solidify quickly and at the same time float its oxides to avoid including them. Cope shrinkage is more pronounced and calls for higher and consequently more powerful pressure gates the phenomena explaining, no doubt, on the depletion by precipitation of lead from crown surfaces and the well known intensity of shrinkage in copper uncombined. Castings should be shaken out at cherry-red heat rather than left in the sand until cold. It is a remarkable feature that at this cherry-red temperature no expulsion of lead immediately occurs in the air and that while yielding to expelling forces at lower temperatures, the casting cooling to atmospheric temperature in the atmosphere gives stable evidence of escape from that extremity of segregation invariably forming a part of cooling in the mold. It would appear that in atmospheric radiation the expelling forces encounter a reducing influence and abridge in duration by a quickening radiating peace. Other than these considerations shaking castings out hot is undoubtedly bad practice.

As to furnace practice, it should be of the best, the effect of copper-fusing temperature on pure lead readily explaining the stand; the metal casts just as satisfactory from the direct method as from first pigging and then casting. In working new with scrap metal the better practice is to first reduce the copper of the new, add the scrap and finally the lead of the new. At this juncture the remark might be well fitting that the high lead alloys are among those our experience counsels not to subject to air and oil methods at least not in the type of furnace we operate. In this connection further we have it from reliable source that the electric is a highly satisfactory furnace to employ in the class of work, our informant, a foundryman, claiming that, all things else being equal, incorporation derives decided benefit therefrom. Charcoal and borax are among the most satisfactory fluxes.

Regardless of practice, absolute exemption from segregation in high lead has never been our experience. Nor are we by any means convinced that our own experience is far from the average. Through the intermediary channels of reading and of conversation has come to us the story of other men's troubles which in so many ways would seem to parallel our own. From thier methods we have derived details of benefit and they perhaps from ours, but the problem of absolute success, of manner and method that will produce in a casting of any size and any form a strictly homogeneous structure throughout and an undiminished lead content from a 30 per cent lead introduction, remains as ever a difficulty beyond the power of either to completely dissolve.

Even so, lack of absolute homogeneousness cannot urge the high lead casting altogether out of favorable consideration. Otherwise instead of continuous application, locomotive equipment on the Pennsylvania would have discarded the high lead product on results of its first trial some ten or fifteen years ago. As to using voluminous risers objective to a feeding back function in the molding process, we have never considered this as being essential

to the bearing casting. At the most it could do little more than operate toward equilibrium between depletion and replenishment of lead in sum total with no assurance whatever of uniformity in distribution and consequent homogeneousness. Among the many incorporating agents for which claims more or less strenuous have been advanced, we mention the following: Nickel, ferro manganese, galena, virgin antimony, calcium, sulphur, boron.

On the merit of these different auxiliaries, either composite, individual or relative, we deem the present no occasion to dwell, the written discussion desisting from any attempt whatever to either laud or condemn a commercial product or precess. To the verbal discussion of the convention we assign this evaluation of worth and sincerely hope that the convention will exercise its full powers of inquiry into the true tatus of each and every one so far as known. We believe the subject worthy and non-ferrous foundrymen in general in need of an exhaustive discussion of this important particular. To this end, and from a sense of justice as well, we have written different manufacturers and advocates of the different products stating our exact position with regard to their individual product and requesting them to expound the principles of their contention, defend their claims and exemplify their accomplishment either by submitting written discussion or joining in the verbal at the convention. The fact of request by the membership is evidence of the importance of and interest in such discussion and we believe fully warrants the meaures we have thus taken.

The chill-molding idea formulated no doubt on a commercial incentive leagued with the hope of a more homogeneous casting. It applies chiefly to the crown-brass variety of work embodying castings usually heavy and highly duplicate. Locomotive driving-box shells are an example and illustrate demand and supply on a most extensive scale. These castings resemble an oblong cylinder cut in half and observing a maximum thickness through the crown. They run from 50 to 200 pounds and represent almost exclusively our experience in chill molding bearing metals of copper base. From this experience evidence has arisen that results advance with an increase of the lead content. From neither the low nor the conservative do we have knowledge of much success. From the higher percentages fairly satisfactory castings are possible, though we have never conceded these castings equal in rank to the sand molded. They have a tendency toward blow holes, shrinkage, and a most unsightly appearance. They look as though they had been up against the smallpox, the condition arising from the sweating out lead adhering in spots to the walls of the mold and breaking away from the casting in removing it. A further detrimental feature is pouring position, which is always vertical. In advertisement we have seen the contention set up that absolute immunity to metal-included sand is balance-turning evidence favoring the chill method. We concede the argument no stability whatever believing the sand made casting, properly molded, to escape this evil every bit as completely as the chill. If exclusion of sand were our greatest difficulty we would be happy.

Two methods prevail in chill molding, the one producing a casting altogether independent of the driving box, the other resorting to the driving box as a back-forming part of the mold into which the metal is permanently poured.

To silence friendly argument, Mr. W. H. Wood some twelve years ago improvised an iron chill mold and cast 3 crown-brasses from it in the Altoona Brass Foundry of the Pennsylvania Company. These castings were cold broken and found promising. Mr. Wood then developed the process with the view of producing on a commercial basis and of eliminating those detrimental details of consequence always attending experimental effort and exposed by it. His labors were to that degree successful that this foundry has been producing by this original method ever since. Briefly, the idea amounts to a heavy, cast iron chill mold of two parts, the one forming the back, the other the journal part of the casting. End partings occur at or near the middle of the mold, which when assembled is completely closed. The molds are poured in standing up position or on end. The pouring end of the chill is slotted out to accommodate an insetting dry sand core through which the gate hole proceeds into the mold. On the top of this core a green sand head about 3 inches high is placed to afford pressure and yield a cushion effect. The chills are well preheated, and painted with a solution consisting of lamp black, alcoholene and shellac. They are then assembled and poured, the pouring metal being reduced to a rather low temperature out of respect to the longevity of the chill mold and the facility of removing the casting therefrom.

Personally, we believe the advantage of this process to limit too rapid freezing of the metal promoting homogeneousness. As to saving, we seriously doubt the stability of the proposition, especially as compared to machine molding. Considering cost of mold up-keep, extra finishing stock and expense of getting the casting into merchantable shape, first impressions of saving will be found to be sadly misleading. Morever, the method is far from congenial to execute. With 5 chill molds to work with, I had rather make 20 sand castings than 15 chill. These remarks, we might state, are made with no reflection on Mr. Wood, he coinciding in many of the opinions expressed.

In principle the method of casting directly into the driving box is practically the same and the saving undoubtedly real, since back-finishing of the casting is thereby eliminated. Cast-iron boxes cannot be so successfully manipulated as those of steel or semi-steel. A handicap heretofore encountered located in the difficulty of realizing a permanently tight fit of the brass in the box. At our plant this is completely overcome by heating the box wedging it slightly apart, pouring the mold and shortly removing the wedges. The box then closes in tight and obviates the difficulty.

Super-heated steam is forcing a departure from the standard tin-lead-antimony metallic package. In substitution copper 50, lead 50 is promising. In manipulating this extremely high lead mix we know Galena to produce very satisfactory results. The castings are light and chill quickly in the sand. As to chill molding these castings, we might state we have never been favorably impressed with the idea. The process works to maximum advantage with the lead-tin-antimony mixture, but the copper 50, lead 50 is a different proposition in the premises. To avoid contention, we might state further that coming from the mold and applying to service the metallic packing casting and the crown-brass are also entirely different affairs.

In conclusion, we wish to reëmphasize two points; the first is that mention of the different incorporating agents in no wise carries with it our supporting opinion. These agents in different instances represent claim-advancing literature sent us, and on which we prefer silence to written argument. From the second point radiates our desire for full and free discussion. We believe the subject worthy and leave it to the convention to make good the opportunity.

ALLOYS OF MANGANESE AND COPPER

Some Minute Contrasts.

Written for The Metal Industry by James Scott.

Alloys of manganese and copper are of the highest possible value in cases where a metal with great resistance to heat and also to electrical action is needed. Metals of this composition have found widespread appreciation in connection with locomotives, in which the stay bolts of the fireboxes are frequently made of them, the usual content of manganese ranging between 4 and 6 per cent. They must, however, in these circumstances, be out of the reach of actual flame, otherwise injurious oxidation may be set up.

It will not be necessary to name the many directions in which these alloys are adaptable, as the metal worker will no doubt be familiar with most of them. It should be noted that they have nothing to do with manganese bronzes, which consist of copper and zinc (brass really) toughened by *small* quantities of manganese.

Manganese, as is well-known, is a very hard and brittle metal, whereas copper is ductile and not exceptionally hard. Upon adding manganese to copper, immense strength is conferred upon the latter; and this trait is especially serviceable where extreme heat is experienced.

In dealing with an alloy, so far as its merits and defects are concerned, it becomes expedient to bear in mind the respective melting points of the various constituent elements, as a great deal of the success or failure, as the case may be, is due to these matters. In the present example readers are reminded that manganese melts at about a temperature of 1,233 degrees Cent. (2,251 degrees Fahr.), while copper melts at somewhere near 1,084 degrees Cent. (1,983 degrees Fahr.). Slight variations are given by different investigations. These figures are modified according to the manner in which the metals behave when

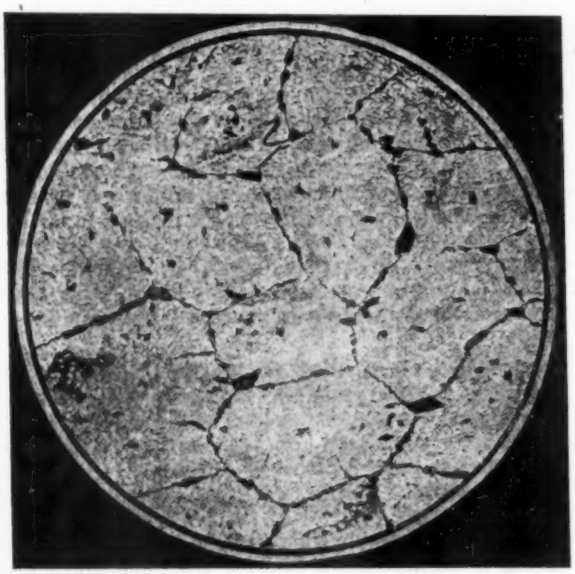

FIG. 1.—1-24TH IN. OF 11 PER CENT. MANGANESE-COPPER. COPPER-RICH CRYSTALS. THESE ARE IN A MANGANESE-RICH MATRIX. EQUILIBRIUM IS NOT PERFECT. MAGNIFIED.

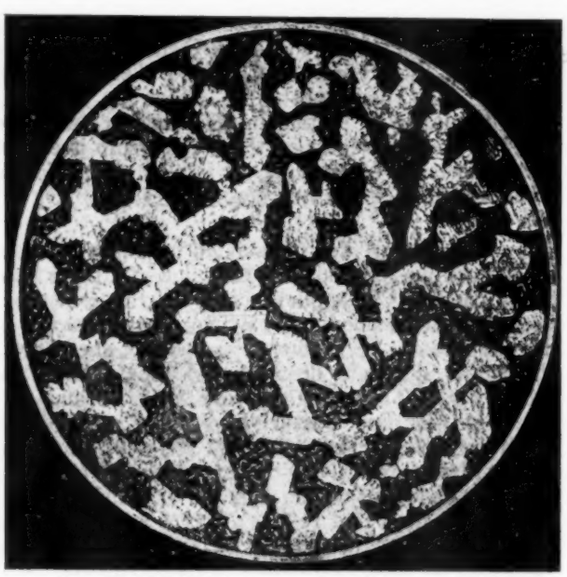

FIG. 2. 1-24TH IN. OF 28 PER CENT. MANGANESE-COPPER. THE MIXTURE OF CRYSTALS IS NEARLY UNIFORM, ONLY A SKELETON OF MANGANESE-RICH MATERIAL BEING PROMINENT. MAGNIFIED.

Manganese and copper can be melted together in all proportions, with the result that a series of solid solutions or mixed crystals, are produced, there being no eutectic nor chemical compounds. The two metals blend very well together, and in cooling and solidifying from the molten condition diffuse regularly throughout one another, the pattern of crystallization being dependent on the relative amounts of the individual metals present. With certain percentages a copper-rich and manganese-rich framework interlace one another as shown in No. 1. When this alloy is satisfactorily annealed equilibrium is assured, and the two components are resolved more uniformly, the copper of the copper-rich portion passing into the manganese-rich one; while the manganese of the manganese-rich area passes into the copper-rich portion. The structural texture is then much finer, since the whole becomes more homogeneous. In a practical sense initial cooling from the molten state does not always permit of complete fusion of copper-rich with manganese-rich solutions; and so a somewhat bold crystallization follows; but subsequent annealing induces further mutual dissolving, with the consequence mentioned.

in mutual combination. An alloy of 68 per cent. copper and 32 per cent. manganese has the lowest melting point of this series.

It should be remembered that copper oxidizes about 400 degrees Cent., whereas manganese rapidly oxidizes in the air at ordinary temperatures. But the double mixture is considerably modified in this respect.

Presuming that a manganese-copper alloy is attacked by overheat, the minute particles of oxidized metal would gradually lose their cohesive power, and fall away from wearing surfaces, besides rendering the whole mass friable. But these dangerous possibilities can be avoided if judgment is properly exercised in regard to the positions and uses of the alloys.

It may be advisable to point out that the complete oxides of both manganese and copper are black, while the incomplete ones of the first are reddish, and those of the latter greyish-green with an approach to red. The black oxides of these metals are known as manganic and cupric; while the colored oxides are chiefly manganous and cuprous.

But other hues are associated with oxidation when the

separate minute particles are considered by themselves. This phase does not call for further detail here, as it applies more particularly to processes of corrosion; and I am mainly desirous of dealing with the subject of integrity. Still, it is always best to note the possibilities of an alloy, because in this way we can better guard against submitting it to unsuitable conditions.

It is not fair to use a substance of this kind for purposes which may render it liable to rapid deterioration. As manganese-copper alloys consist of mixed crystals of the two metals, each is open to attack in cases where an actual chemical compound might be immune. The maintenance of a sound condition is desirable, as oxidation or undue disintegration is then hindered, and the life of the alloy beneficially extended. Only under the severest and probably unjustified tests would such a combination of metals be capable of proving troublesome. As a rule, in

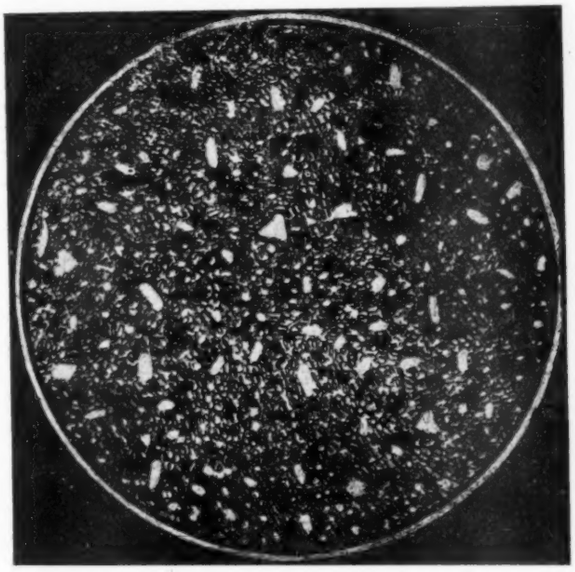

FIG. 3. 1-24TH IN. OF 25 PER CENT. MANGANESE-COPPER, COPPER AND MANGANESE CRYSTALS ARE EQUALLY DISTRIBUTED. MAGNIFIED.

the newly prepared alloys a primary skeleton of either copper-rich or manganese-rich constituent lies in a ground mass of manganese-rich or copper-rich mixture, according to the respective percentages. As the proportion of one element is increased, or lowered, in comparison with the other, a corresponding gradual change is introduced, without any very definite demarcation between them. In other words, the tendency for each metal to fuse regularly in the other is an inherent feature.

The present remarks and illustrations have been based on alloys kindly supplied for investigation by The United Brassfounders and Engineers Ltd., of Cornbrook, Manchester.

Unless we etch a sufficiently smooth alloy with a solvent chemical it is often difficult to understand its precise formation. In this case the best solution for the demonstration is one of acid ferric chloride—that is, chloride of iron with an acid reaction. Upon standing the alloy in this liquid for a certain length of time it partly consumes the outer layer or crust, and lea .s the various items more clearly exposed. If copper and manganese are separately laid in acid ferric chloride the copper becomes light-brownish, while the manganese becomes dark-grey. These changes give us a clue to the peculiarities of the etched alloys. In the alloy thus treated the copper-rich constituent is therefore caused to appear brighter and lighter than the manganese-rich area, unless annealing has rendered the mixture more homogeneous, or intimately distributed, as explained elsewhere, when the variations are less noticeable or, more correctly speaking, not so pronounced in dimensions.

In No. 2 is shown an alloy of 28 per cent. manganese and 72 of copper, after being etched with acid ferric chloride. We do not observe such striking contrasts between the copper-rich and manganese-rich sections, because the crystals are extremely minute and uniformly scattered; and also for the reason that as one element is dissolved in the other to a greater extent than in the first sample inspected, the percentage of each in each approaches the ideal. That is to say, taking an alloy in which bright copper-rich crystals of conspicuous character are set in a dark ground mass of manganese-rich material, the first named naturally contains more copper than manganese, and the second contains more manganese than copper. But after proper annealing, the differences between them are not so strong, copper and manganese having displaced—and replaced—one another, so as to allow, when cooled, a mass consisting of very minute crystals, in which an excellent balance of the two elements is obtained. Absorption is almost perfect, there being merely thin borders of manganese-rich material round aggregates of the remainder.

It should be understood that after-treatment of a manganese copper alloy effects these remarkable modifications. As the original molten alloy is solidifying, time is not given for the two metallic elements to thoroughly diffuse one into the other, but subsequent reheating enables this condition to be established to a useful degree.

In No. 3 is shown an alloy of 25 per cent manganese and 75 of copper, after the customary etching. There the component elements have been so thoroughly melted together and poured that a neat disposition of them both has occurred. The better an alloy is to begin with, the less anxiety need be felt in its after-treatment.

There is a valuable alloy called *manganin* which is composed of 82 per cent copper, 15 manganese, and 3 of nickel and iron. While it is not strictly speaking a manganese-copper product it is worth mentioning here, as it *practically* comes under the heading of this article, since the proportions of nickel and iron are so small and the quality no doubt depends principally on the manganese and copper which dominate it.

NICKEL STRIP.

The strip should be made up in a two-gallon jug in the following manner: Pour the nitric acid in first, then the sulphuric acid, and let stand over night. Then add the hydrochloric acid. This should be done out of doors, as some sulphur and chlorine fumes arise. Let this solution stand for two days before using, and, if it works too fast, add about 4 ounces of sulphuric acid at a time until there are no gas bubbles given off, or try an old piece of nickel-plated iron.

THE SOLUTION.

Nitric acid 36° Baume.....	½ gallon
Sulphuric acid 66° Baume.....	½ "
Hydrochloric acid 18° Baume.....	¼ "

This solution works best cold, and in warm weather the jar should be set in cold water. After being used for some time a white precipitate forms, and the solution should be allowed to settle, and then clear solution can be poured off.

Under no circumstances should any water get into the acid, and the work must be perfectly dry before putting in the solution.—J. C. K.

THE ANALYSES OF BRASS OR BRONZE AND BABBITT

An Address Presented Before the American Institute of Metals, Boston, Mass., September 24-28, 1917.

By E. W. Hagmaier, Superior Rubber Company, Inc., Buffalo, N. Y.

The methods which this paper will endeavor to set forth are by no means entirely new. A few steps may be changed here and there, such changes being found advisable from experiments. As a whole the methods which shall follow represent those which the writer has found satisfactory for commercial analyses, especially adapting themselves into a scheme of analysis where speed is possible.

The principal point upon which the writer wishes to lay emphasis in this paper is the time factor. America and speed have become synonymous in the commercial and manufacturing world. Top-notch speed is the natural operation of all factories, it is only to be expected that speed be desired from the laboratory.

Chemistry in all its branches has quite recently received its proper place in this country. Its importance has been proven. Formerly in many instances the chemical laboratory in connection with numerous plants was more or less of a side show than an important unit in the plant's operation. This condition has completely changed now and the real value of chemical control, analyses, and research has been demonstrated and their value proven.

This sudden recognition of the importance of chemistry has been as one might say over night. This sudden awakening has not, in a great many instances, allowed those in authority in plants where this truth has been driven home to adapt themselves to conditions necessary for the smooth operation at top speed of the chemical department. The speed idea mentioned at the beginning of this paper, is immediately applied to the laboratory. In many instances those occupying executive positions in these plants, have only a vague idea of elementary chemistry and no analytical chemical knowledge whatever. Nevertheless they proceed to formulate plans for speeding up the laboratory. In many instances plans are decided upon without having any conference with the chief chemist. If by chance the chief chemist is consulted, from experience the writer can truthfully say that any statement which the chief chemist might make in regard to actual time of operations will be considered absolutely extreme, and a substantial discount taken from his time statement.

There are many factors involving time, over which the chemist has no power, but which are not taken into consideration by those in executive positions. There are also many cases where the chemist does not properly divide his work to utilize all his time to the best advantage. It is with this point in mind, as stated before that this paper intends to emphasize. After giving the statement of the methods of analyses for the component elements of brasses or bronzes and babbitts, it is the writer's intention to then give the manipulation of these methods. The object of this is to show how most all available time can be utilized. From experience the writer has observed that one of the big failures in laboratory operation where speed is essential is not so much on account of methods used but to improper manipulation of methods.

We will now give the scheme of analysis and as stated follow this with the method of manipulation.

ANALYSIS OF BRASS OR BRONZE—DETERMINATION OF TIN

Dissolve one gram of the material in twenty-five cubic centimeters of (1-2) nitric acid and evaporate to a paste. Remove from the hot plate and add twenty-five cubic centimeters of (1-4) nitric acid and warm to dissolve all soluble metals; when solution is complete, filter, washing well with hot water, alternating with hot 2 per cent nitric acid wash. When thoroughly washed add five cubic centimeters of concentrated sulphuric acid to the filtrate and place on the hot plate to evaporate to fumes of sulphuric acid.

The precipitate which contains the tin and also any antimony or phosphorus if these elements are present, is placed in a weighed porcelain crucible and very slowly incinerated. Care must be taken to char the paper slowly in order not to reduce the oxides. When completely ignited the crucible with its residue is cooled in a dessicator and then weighed. To the crucible now add potassium bisulphate and make a fusion; when a clear fusion is obtained allow the melt to cool and then leach out with warm water. Transfer the solution to a five hundred cubic centimeter Erlenmeyer flask, add twenty-five cubic centimeters of concentrated sulphuric acid and then add several crystals of potassium iodide and take down to fumes. After the flask has fumed for about five minutes remove from the hot plate and cool, then add one hundred cubic centimeters of water and ten cubic centimeters of hydrochloric acid and boil for five minutes. Remove from the plate, add one hundred cubic centimeters of water, cool and titrate with N/10 potassium permanganate solution and calculate antimony. Calculate the antimony found to oxide and deduct this weight from the combined weights found from the ignition. If no phosphorus is present the percentage of tin and antimony can be calculated. If phosphorus is present this will have to be determined and also deducted from the combined weights obtained at first, in order to obtain the percentage of tin. The method of phosphorus determination will be given later.

DETERMINATION OF LEAD

The filtrate from the tin, antimony, and phosphorus which has been taken to fumes of sulphuric acid is cooled and fifty cubic centimeters of water added, warmed and filtered. The precipitate is washed thoroughly with hot two per cent. sulphuric acid wash water till free from copper and other impurities. The precipitate is then placed in a weighed porcelain crucible and carefully ignited and then cooled and weighed and the percentage of lead calculated.

DETERMINATION OF COPPER

The filtrate from the lead sulphate is now ready to be electrolized to deposit the copper, about one and one-half amperes being used.

DETERMINATION OF ZINC IRON, AND MANGANESE

The filtrate from the copper electrolysis is made ammoniacal, sufficient ammonium hydrate being added to redissolve any zinc or nickel which might be precipitated, several crystals of ammonium persulphate are added and the solution boiled; this will precipitate the iron and manganese. Filter off this precipitate and wash with hot water. When sufficiently washed place filtrate on the hot plate to evaporate to a low bulk for zinc precipitation. The filter paper containing the precipitate of manganese and iron is placed in the original beaker and fifteen cubic centimeters of (1-2) hydrochloric acid, added, the paper well broken up with a stirring rod and

the contents warmed to dissolve the precipitate. Add fifty cubic centimeters of water and bring to a boil, add several grams of ammonium chloride and again make ammoniacal and filter off the iron hydroxide. Ignite this precipitate and calculate iron.

In the filtrate from the iron pass hydrogen sulphide to precipitate the manganese. Filter off the sulphide precipitate, wash and then redissolve the sulphide in dilute nitric acid, boil the solution several minutes, then add silver nitrate solution and ammonium persulphate; cool, filtrate and titrate the manganese with sodium arsenite solution, and calculate the percentage of manganese.

The original filtrate from which the combined iron and manganese was first filtered and which was evaporated to a low bulk is brought close to neutral, microcosmic salt added, and several drops of ammonium hydrate and the zinc precipitated as phosphate. After the precipitate of zinc phosphate has become crystalline it is filtered off, ignited in a porcelain crucible and weighed and the percentage of zinc calculated. The precipitate of zinc pyrophosphate must be very carefully and slowly ignited if good results are to be expected.

DETERMINATION OF NICKEL

The nickel is determined from a filtrate from which the tin and lead has been removed as already stated. This filtrate is then made ammoniacal and the precipitate of iron and manganese which might appear is filtered off and the filter washed. The filtrate from this is treated with several cubic centimeters of a one per cent alcoholic solution of di-methylglyoxime and placed on the hot plate where it will be just at a boiling temperature; this will precipitate the nickel as nickel glyoxime. After being thus heated for about an hour the precipitate is filtered off onto a weighed Gooch crucible or weighed filter paper, washing well with hot water. After being sufficiently washed the paper or crucible is dried in the oven and again weighed and the percentage of nickel calculated.

DETERMINATION OF PHOSPHORUS

As stated at the beginning the phosphorus is precipitated with the tin. Its complete precipitation at this stage will occur if there is six to seven per cent of tin present for each one per cent of phosphorus. The combined precipitate of tin, antimony and phosphorus obtained from the nitric acid treatment as stated in the beginning is ignited in a porcelain crucible; to the ignited residue add potassium cyanide. It is quite essential that the cyanide used for this purpose be free from phosphorus or that a blank be run in order to determine the amount of phosphorus which might be present in this reagent. After the fusion has been carefully made (under a hood), allow the crucible to cool and then leach out the melt, and boil several minutes, after which filter. Place the beaker containing the filtrate under the hood, carefully acidify with nitric acid, then place on the hot plate and boil fifteen or twenty minutes. Filter into an Erlenmeyer flask, add sufficient nitric acid for phosphorus precipitation, add ammonium molybdate solution, shake flask thoroughly for several minutes and let stand for about an hour, after which filter off the ammonium phosphomolybdate, precipitate and determine the percentage of phosphorus.

The phosphorus must also be calculated to P_2O_5 and its weight deducted from the combined weights of tin, antimony, and phosphorus first obtained in order to be able to determine the percentage of tin in the sample.

ANALYSIS OF BABBITTS FOR TIN, ANTIMONY, LEAD AND COPPER PREPARATION OF THE SAMPLE

Break or saw the ingots squarely across and file after removing the roughness. If care is exercised an accurate sample of the cross section can be taken. A sample may also be taken by sawing through the ingot several times and collecting the sawings. These sawings or filings should be gone over with a magnet to remove any iron which might contaminate the sample.

ANALYSIS FOR ANTIMONY

Place one gram of the filings in an eight hundred cubic centimeter Erlenmeyer flask, add ten cubic centimeters of water and twenty-five cubic centimeters of concentrated sulphuric acid. Place on hot plate and fume until all black has disappeared from the bottom of flask and precipitate is white. Now remove from the hot plate, cool, add one hundred cubic centimeters of water and ten cubic centimeters of hydrochloric acid and boil ten minutes. Cool, add another hundred cubic centimeters of water and titrate with N/10 potassium permanganate solution.

ANALYSIS FOR TIN

Place a half gram sample of the filings in an eight hundred cubic centimeter Erlenmeyer flask, add thirty cubic centimeters of concentrated hydrochloric acid, apply gentle heat. If complete solution does not occur in reasonable time add several crystals of potassium chlorate. The chlorate should be added sparingly in order not to weaken the acid too much. When solution is complete add one hundred and fifty cubic centimeters of water and eighty cubic centimeters of hydrochloric acid, place a strip of ingot iron in the flask and cover the flask with an inverted porcelain crucible cover, and boil for one hour, or until all the tin is reduced. Remove the flask from the plate, cool under the tap, when cold remove the strip of ingot iron and titrate at once with N/10 iodine solution.

ANALYSIS FOR LEAD

Place a one gram sample of the filings in a two hundred and fifty cubic centimeter beaker and add from five to fifteen grams of tartaric acid. The amount of this acid to use will depend on the amount of tin in the sample, the greater the amount of tin the larger the amount of tartaric acid that will be necessary to hold the tin in solution. To the beaker containing the acid and sample add fifteen cubic centimeters of boiling water, and three cubic centimeters of concentrated nitric acid. When solution is complete add three cubic centimeters of sulphuric acid and boil until all brown fumes have ceased to come off, allow to boil one minute more after the last fumes cease and then remove from the hot plate. Care must be taken not to boil too long or the sulphuric acid will char the tartaric acid. After removing the beaker from the plate cool and add fifty cubic centimeters of water and filter off the lead sulphate, washing well with two per cent sulphuric acid; wash. Dissolve the well washed precipitate from the paper with hot saturated ammonium acetate solution, add two cubic centimeters of acetic acid, bring the solution to a boil and add potassium chromate, boil until the lead chromate settles and then filter on a weighed filter paper or Gooch crucible, washing the precipitate with hot water and then drying the paper or Gooch in the air bath. Calculate the lead chromate to lead.

ANALYSIS FOR COPPER

Treat a two gram sample in the same manner as that just described; after the lead sulphate has been filtered off, take the sulphuric acid filtrate, add two or three cubic

centimeters of hydrochloric acid and several pieces of copper free aluminium stick and place on the back of the hot plate. This will throw out the copper as metallic copper; when all the copper has been thrown out, filter and wash several times with hot water. Dissolve the copper off the paper with hot dilute nitric acid. When this solution is obtained the copper may be determined by thiosulphate titration or by electrodeposition.

Having given the general scheme of analyses I will now proceed to give the method of procedure which has for its aim the utilization of all available time, making each step dovetail into the next and taking advantage of time for evaporation and such like.

This method of procedure is as follows:

Weigh out four one-gram samples of the brass or bronze drillings into four two hundred and fifty cubic centimeter beakers. Treat these with dilute nitric acid as directed. After the acid has been added and while the solutions are evaporating to a paste ignite six or eight porcelain crucibles, and place them in a desiccator. If by this time the solutions which are evaporating have not gone low enough proceed to weigh the crucibles, recording the weights of the crucibles for future use. By this time the nitric acid solutions should be ready to filter. Filter them into two hundred and fifty cubic centimeter beakers, decanting as much of the solution as possible. When the solution has been decanted add about twenty-five cubic centimeters of hot water to the beaker, break up the precipitate in the beaker with a stirring rod, allow precipitate to settle and again decant. Now wash several times with hot nitric acid wash, decanting as before. Wash paper several times with the acid wash and water, and then remove the beakers with the main portion of the filtrate from beneath the funnels, replacing them with four four hundred cubic centimeter beakers. To the beakers containing the main filtrate add five cubic centimeters of sulphuric acid and place them on the hot plate where they will maintain a boiling temperature. If care is taken in placing them it will not be necessary to place a watch glass on the beakers. While these solutions are evaporating return to the precipitates and wash them onto the filter washing thoroughly to be sure that no copper remains on the filter. Since copper is the element present in greatest amount it is safe to assume that when all copper is washed out other impurities will be washed out. These washings are caught in the four hundred cubic centimeter beakers which have replaced the ones which held the main portion of the filtrate. When the precipitates have been sufficiently washed ignite them in four of the porcelain crucibles which have just been prepared. Record the weight of the crucibles and residues. To two of these crucibles add potassium cyanide as directed in the phosphorus determination, and start the fusion. If antimony is to be determined, take the other two crucibles and add potassium bi-sulphate and proceed with that fusion as directed in the scheme just given. One condition which will govern to a greater or less degree whether there is a probability of an appreciable amount of antimony in a sample is the market price of this metal compared to that of tin. When the price of tin is very high the chances of there being antimony added are greater. This has been the writer's experience and is only mentioned at this point.

Leach out the above mentioned fusions, and proceed as has been stated. While the two for antimony are going to fumes, prepare the two for phosphorus and proceed to precipitate. By this time the filtrates which have been evaporating to throw out the lead as sulphate should be about down to fumes. Proceed to filter these into the four hundred cubic centimeter beakers which contain the washings from the filters. Wash these precipitates as directed for lead. When the precipitate has been sufficiently washed, prepare the cathodes and proceed to electrolize two of the solutions.

Place the precipitates of lead sulphate into two porcelain crucibles, saving two in case a check should be necessary, start these to ignite slowly. By this time the antimony will have evaporated to fumes; prepare this for titration and titrate the antimony, and calculate the percentage of this metal present.

The two filtrates from the lead sulphate which have not been used for electrolysis are now made ammoniacal, several crystals of ammonium persulphate added and boiled. The precipitate of iron and manganese is filtered off and washed. This ammoniacal filtrate is now placed on the hot plate and dimethylglyoxime added as directed for nickel. The precipitate of iron and manganese may be dissolved off the paper with dilute sulphuric acid containing a small amount of ferrous sulphate and from this solution the manganese can be determined as directed. By making this step here it does away with the necessity of a hydrogen sulphide precipitation as directed in the general scheme.

By this time the phosphorus will have stood long enough, especially if it has received proper agitation. A machine for this purpose is a very good equipment to have in the laboratory. The phosphorus may be determined by filtering onto a weighed paper or by filtering and determining by acid alkali titration.

The copper electrolysis should be about completed by this time. This can be determined by moving a fresh part of the cathode down into the solution and seeing if copper is plated thereon, or a small amount of the solution may be drawn off and tested with ammonia. While waiting to see if more copper is being plated out on the cathode, weigh up the lead sulphate which has been burned off, calculate the lead, calculate phosphorus, antimony and tin.

If proper currents are carried the copper should be all thrown out by this time. Wash the cathodes well with water, and then dip them into alcohol after which place them in the oven for a few minutes. Remove from the oven and weigh.

The filtrates from the copper are treated as directed in the scheme of analysis for zinc, and iron.

The method of procedure for babbitts is as follows:

Weigh in duplicate samples for antimony, tin, lead, and copper. Treat the samples as directed in the scheme of analysis. While those for tin and antimony are going into solution, proceed with the ones for lead and copper. When these are ready, filter and add to those intended for the copper titration the pieces of aluminium and place them on the hot plate to throw out the copper. The precipitates of lead sulphate intended for the lead determination are dissolved in ammonium acetate and chromate added as directed and the beakers placed on the hot plate to boil. By this time the tin and antimony will be ready for attention. Proceed with them as directed and by the time this is finished the copper and lead chromate will be ready to filter and the necessary steps for their completion taken.

This method for babbitts compared to others which the writer has come in contact with is very short, does away with considerable manipulation and from experience is quite reliable.

No doubt after following the procedures as just given many will wonder why it was necessary to go into such an explanation of the steps. The reason is this, that the writer is satisfied that it is in the manipulation that real speed is developed in chemical analyses.

CHINESE METAL MANUFACTURES

A Description of the Production of Artistic Articles in Silver, Copper, Brass and Pewter by the Metal Workers of Interior China.

Written for The Metal Industry by H. K. Richardson.

Third and Last Paper.

MANUFACTURE OF COINS.

Practically all of the machinery for this work was bought in foreign countries. American machinery predominates in the silver department and English in the brass coin department. About two years ago the use of the modern coal fire casting shop in the Chengtu mint was abandoned, while a new casting shop using Chinese furnaces and bellows was started. The inspector claimed that the cost of running the Chinese type was less. What is more probable is that some one wanted to make a few more jobs, for the motto of the Chinese employer is "Never do by machinery that which can be done by hand." This motto is not such poor economics as it looks when day laborers are plentiful at 6 to 8 cents per day. Experiments were also under way to replace the expensive graphite crucible from Germany with locally-made clay pots. Six to eight heats were obtained from the clay pot to 30-40 from a graphite pot. This was good economy, for the clay pots hardly cost one-twentieth of the graphite pots.

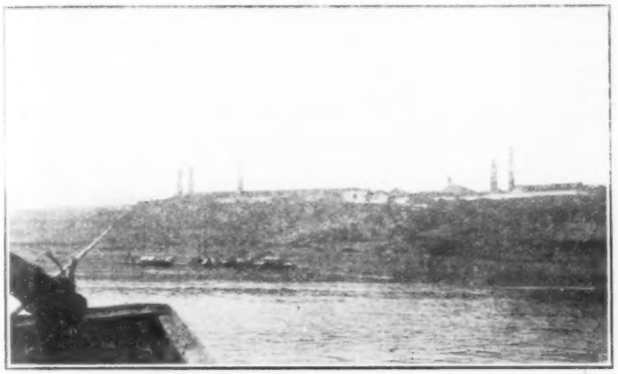

FIG. 10. VIEW OF MINT AND BUILDING TAKEN FROM A BOAT ON THE YANGSTZE RIVER.

FIG. 11. MINT AT CHUNGKING SHOWING MODERN (GERMAN) CASTING SHOP.

The troubles which culminated in the 1911 revolution started because the Manchu government of Szechuen diverted some 5,000,000 taels (about $3,500,000) that had been subscribed by the people for a railroad, to the building of a modern mint at Chungking. This mint is equipped with two completely independent sets of machinery, one German, one English. Only the German is set up and running. The accompanying photos, Figs. 10, 11, 12, 13, were taken in March, 1912, when the writer appraised the plant for the then revolutionary governor of the province.

SILVER WORKERS.

The apparatus of the silver worker is small; a blow pipe, and charcoal fire, a few tools and an anvil complete the equipment. They are clever workmen, making mostly earrings and ornaments of adornment for the ladies. They are clever imitators, as will be seen from the following photo, Fig. 14. All these pieces of silverware were made from cuts taken from an English cata-

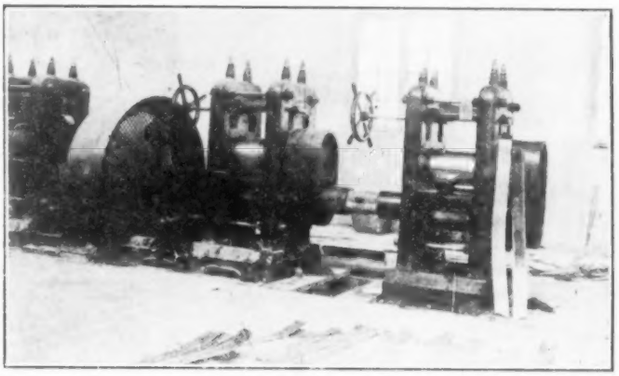

FIG. 12. GERMAN BREAKDOWN ROLLS FOR COIN BLANKS IN MINT AT CHUNGKING.

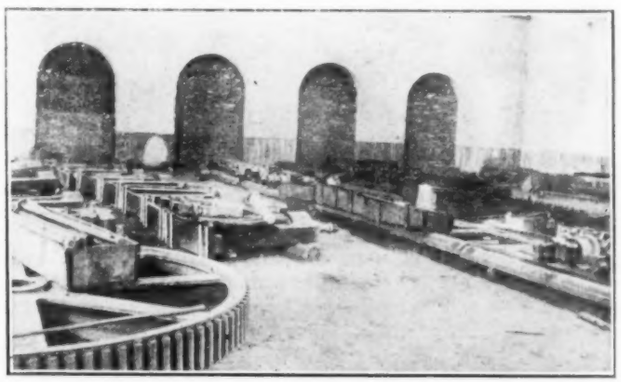

FIG. 13. ENGLISH MACHINERY WHICH HAS NOT BEEN SET UP OWING TO SLOWNESS OF CHINESE ENTERPRISE AND WHICH HAS BEEN IDLE FOR OVER FIVE YEARS. THE GERMAN MACHINERY WAS SET UP AND USED DUE TO THE QUICKER DELIVERY AND FOLLOW UP ON PART OF MAKERS.

log. The total cost was less than $15.00, and the silver is pure material, rather soft and of matt surface, but extremely well executed.

An odd practice of payment is followed by the silversmiths. They charge for the work as follows: market price of weight of article in ounces of silver plus a charge

for labor. Also when one gives them a special order, he gives them a deposit sufficient to enable them to buy the silver needed; the remainder or the labor charge is paid when the goods are delivered.

PEWTER WORKERS.

Until the event of the Standard Oil can into the interior of China, pewter was the most used metal for the making of tea pots, lamps, and tea cups, saucers. The five gallon export oil tin can in which American kerosene is received is a much prized article and whole shops are devoted to making it useful for Chinese kitchen utensils and oil lamps.

All of the pewter received in Chengtu comes overland from the province of Yunnan. Apparently the lead and tin are mixed at the smelter, for no pure tin can be bought in the city. Three grades of raw material are distinguished:

Prices on Jan. 24, 1916.

(1) Best: i. e., like silver in color.....97.8c. per lb.
(probably nearly pure tin)
(2) White .....43.2c. " "
(3) Melted: apparently scrap containing
solder and lead..... 7.2c. " "
Lead ..... 4.0c. " "

The pewter as sold is designated by three grades:

	3	7	
(1) Best Pewter:	— Lead —		Best Raw Pewter
	10	10	
	5	5	
(2) White: "	— " —		" " "
	10	10	
	73	27	
(3) Poor: "	— " —		" " "
	100	100	

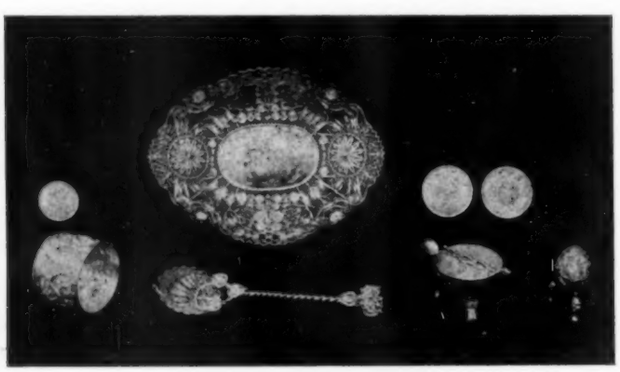

FIG. 14. CHINESE SILVER WORK DESIGNED FROM CUTS FROM AN ENGLISH CATALOG.

Nearly all pewter ware is made from sheets 1-16 inch to ⅛ inch thick, cut, formed to shape and then soldered. Thus all pewter makers are expert solderers, all metal craftsmen follow their ideas in respect to soldering methods. All soldering is done with an iron soldering iron. It weighs about 4 pounds for the irdinary size.

The iron is heated over a charcoal or coke fire blown up with a windbox, only made cylindrical rather than oblong. The fire pot is usually of unglazed pottery, although the five gallon oil cans lined with mud and supplied with a grate are becoming more popular. All fluxing is done with rosin or pine pitch. The soldering iron is cleaned by rubbing on a piece of soapstone or the wooden floor. In soldering the workman rubs the iron hard along junction while feeding the solder to the iron.

Pewter sheets are made by flowing the molten metal over a piece of soapstone provided with side strips. When stone is not available a wooden board covered with cloth is used.

A considerable amount, especially the better grade of pewter saucers, are engraved. Pewter ware is finished by scraping and rubbing with a very fine, sandy wet cloth. The tiles on the famous "Chin Lao Dong," or the "nine caves" temple on the sides of Mount Omei are made of pewter and appear to be sheets about 3-16 inch thick by 18 inches x 9 inches wide.

Fig. 20 illustrates a few pieces of pewterware.

COPPER WORKERS.

The city of Chengtu is famous all over west China for the skill of its hammered copper workers There is a large demand for copper pots and pans, for nearly every restaurant and caterer on a large scale uses copper utensils. Especially large is the demand from the travelling street restaurants.

The methods and apparatus used by the copper workers are simple and practically the same as used by the wrought brass shops.

The degree of skill obtained by these workers is well illustrated by an experience of the writer. Called upon to duplicate a hospital sterlizer and having no sheet copper available, the problem was set before the native coppersmiths. They hammered out several sheets 36 inches x 28 inches x 1-16 inch and only one had to be rejected for holes hammered through. To insure an even sheet they took a weighed ingot of copper and hammered it out to the required area. The cost of this work was (122 cash an ounce Chinese).

70 cash per oz. for copper=$0.263 per lb.
52 " " " " labor = 0.195 " "
122 " " " " total =$0.458 " " for finished sh't.

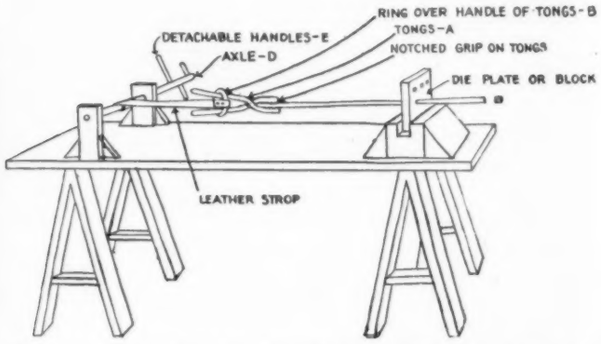

FIG. 15. WOODEN DRAW BENCH FOR DRAWING BRASS ROD DOWN TO SMALL WIRE.

Most of the scale is removed from copper work by use of native copperas. This leaves a fine matt surface. The final finish is obtained by placing the article on a hard surface and tapping it with a hammer. The hammer mark is a shiny dark red spot. Two effects can be obtained, one a pock-marked surface with alternate shiny and matt spots, and another hammered all over and therefor a dark red shiny surface. No further treatment is given the surface of copperware. The dark red polished surface resists corrosion well.

One of the most conspicuous articles in many Chinese retail stores is the copper incense urn. These are cast and are practically the only cast copper work now done.

WIRE SHOPS.

A large amount of brass wire is consumed in the wiring up of artificial flowers, making of brushes and brush-handles. The process is so evidently the protege of our

modern methods that it deserves more than passing mention.

The brass of the wrought variety is cast into oblong bars almost two feet long. These bars are then peaned over an anvil until they are some four feet long and correspondingly wider and thinner. The metal is then cut into strips with a cold chisel. These strips, about 1 inch wide, are peaned out to some 15-20 feet long and about ⅛ inch thick. These strips are then cut up again into lengths that are about square cross section. Thus we have a brass rod ⅛ x ⅛ x 20 odd feet long. These are filed pointed on the end and drawn down to small wire on a heavy wooden draw bench sketched in Fig. 15. The smallest sizes are finished by small hand reels and dies attached to the benches.

The draw press is operated as follows:

The brass rod is pointed by a file to pass through one of the die holes, the pincers A grip the pointed end, Power is applied at D by detachable levers (E) until the leather strap F is pulled tight and the ring B reaches the axle. The strap F is then loosed and another grip gotten on the rod. This usually suffices to pull enough wire through the die so that the wire is attached directly to the axle and the pincers laid aside. In case of a break the work is started over in just the same way. Vegetable oil is used to lubricate the dies. Very fine wire is drawn by this process, as fine as a hair. Iron to a small extent, gold and silver wire are drawn to a limited amount. In case of these metals a smaller ingot is used at the start. This process is said to be over 1,000 years old.

ECONOMIC STATUS OF THE CHINESE METAL WORKER.

To bring to the attention of the average American, especially those who are interested in foreign trade especially with the Orient, the nature of the competition that is to be expected from Chinese sources, the following table has been made out. All the figures given were taken from the books of the shops in question and are for the Chinese year corresponding to 1914:

There are several interesting things brought out in the above table:

(1) *The low wage scale.*

Skilled labor: $15 to $20 per year plus food or a total of $24 to $29.

Apprentices: $1 to $3 per year plus food and quarters, or a total of $10 to $12.

(2) *Low cost of living.*

Food costs about $9.00 per person per year.

(3) *Small capital per shop.*

$108 to $385.

(4) *Fair gain of successful shops.*

18 to 23% on investment besides family fuel and rent free.

(5) *Annual turn-over of capital.*

About twice.

(6) *Labor cost.*

About 1-3 of the total cost of manufactured articles.

(7) *Low labor returns.*

One man does approximately $44 worth of work per year in brass and pewter workers, and $84 in silver industry.

	Brass Shop		Pewter Shop		Silver Shop	
Total capital	.....	$108.50	.....	$147.00	.....	$385.00
Total sales, 1914	.....	$315.34	.....	$280.00	.....	$770.00
Total manufacturing cost of year 1914	.....	$302.11	.....	$313.30	.....	$669.07
Material	$163.93	.....	$158.62	.....	$406.00	.....
Labor—Wages	41.54	.....	72.40	.....	135.66	.....
Food	59.81	.....	43.70	.....	73.70	.....
Fuel	14.11	.....	9.80	.....	16.50	.....
Repairs	3.11	.....	3.40	.....	*.....	.....
Rent of shop	13.20	.....	17.62	.....	30.80	.....
Miscellaneous	6.41	.....	7.76	.....	* 6.41	.....
	$302.11	.....	$313.30	.....	$669.07	.....
Stock on hand—						
New Year's Day, 1914	.....	$9.90	.....	$5.30	.....	$35.00
New Year's Day, 1915	.....	$16.50	.....	$32.67	.....	$24.50
Carried at 8/10 selling price.						
Total profits—year	.....	$19.83	...	(loss) $6.93	.....	$90.43
Earnings on capital	.....	18.3%	...	(loss) 4.7%	.....	23.0%
Number of employees	.....	7	.....	5	.....	8
Skilled workers	2	.....	4	.....	6	.....
Apprentices	5	.....	1	.....	2	.....
	7	.....	5	.....	8	.....
Yearly wages—						
Employer†	.....	$17.60	.....	$18.34	3 bros. each at	
Skilled help	.....	$17.60	$14.66	to $20.16	$18.34	to $23.46
Apprentices	$1.10	to $2.94	.....	$1.47	.....	$2.94
Food supplied extra. Money payment	.....	.....	.....	.....	.....	.....
Quarters to apprentices extra	.....	.....	.....	.....	.....	.....
Cost of food, per person, per year	.....	$8.55	.....	$8.54	.....	$9.21

*Included in merchandise.

†The employer works in the shop; figure given is his customary rating as a workman. He does not draw his pay but takes profits, etc., in a lump sum. It is separated in the above table for completeness' sake. In addition to the above privileges, the employer's family lives in the rooms adjoining the workshop, thus getting free rent and fuel which in the above table is charged entirely to the cost of operating the shop.

(8) *Labor cost to sales ratio of brass worker.*

$15 average wage to $44 work done per man year—Ratio=3.

Note American ratio.

$700 average wage to $4,000 work done per man year—Ratio=6.

BRIQUETTING OF NON-FERROUS LIGHT METAL SCRAP

A Paper Presented at American Institute of Metals, Boston, Mass., September 24-28, 1917.

By A. L. Stillman, E. M., M.SC., General Briquetting Company, New York.

It is no secret that prices of metals of all sorts have been subject to rapid advances during the last twelve months. Never before has there been so great a need for rigid economy in metallurgical and melting practice. It is noteworthy, too, that ingot metal and heavy scrap have shown a far larger proportional increase in price than have the light scrap, chips and borings. Taking yellow brass and aluminum as examples, I have prepared the following charts in which the time elapsed represents the abscissae and the increased price the ordinates. The particular function of these charts is not so much to illustrate the rapid rise in price of these commodities as the greater proportionate rise in the heavy stock.

You will note the area bounded by the two curves—a largely increasing area. It is important because it represents today a great national waste, which is subject to elimination by modern methods. Similar curves

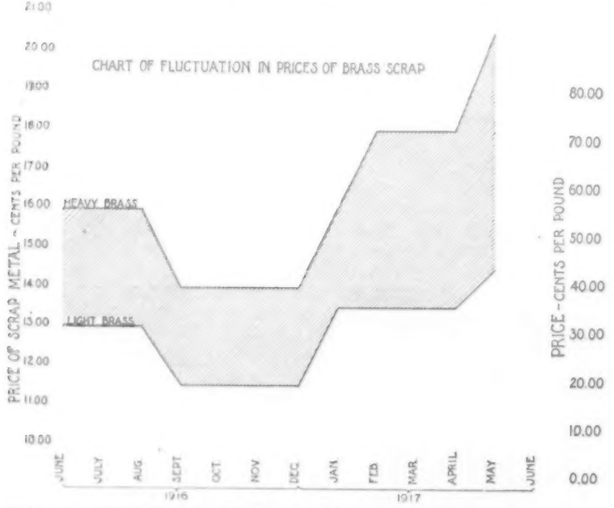

FIG. 1. CHART OF FLUCTUATIONS IN PRICES OF BRASS SCRAP

can be made for tin, zinc, lead and metal drosses.

It is evident that if the light scrap can be so treated, or pressed, that it will be cheaply fabricated into a form metallurgically equivalent to the heavy scrap, a great industrial economy will be realized. At present the use of light scrap in the crucible means a great loss in handling, charging time, and also actual metal losses from burning, oxidation and vaporization. The aggregate of these losses represents the difference in value, roughly, between the two grades of scrap—or the darkened area represented on the chart.

The quotations of May 28, reduced to actual figures per ton show the following:

Brass (yellow), difference in heavy and light scrap per ton	$100.00
Aluminum, difference in heavy metal and borings per ton	660.00
Lead, difference between heavy and light per ton	30.00
Zinc, difference between spelter and light scrap.	33.00

Bundling, or cabbaging—whereby long strips or sheets of metal are pressed into rectangular bundles suitable for melting—has long been established practice. It is recognized economy, and bundles are quoted at an advance over the loose scrap. Bundling, as such, is limited to the long flexible turnings and sheets. Nothing can be done, so far as these cabbaging operations are concerned, with the loose fine needles, the borings, the punchings and the brass washings. That is the function of metal briquetting.

The briquette and the bale are in no sense competitive, at least so far as the non-ferrous metals are concerned, for the reason that they use material in absolutely different form. The bundling, or baling machine, calls for the long and flexible material, while the usual briquetting apparatus has for its ideal the short easily fed boring.

Before proceeding further it might be well to define the term briquette. The dictionary definition is—"Briquette—a little brick." Obviously this is not to be applied to a brass or bronze briquette weighing close to 40 pounds! The term briquette, too, suggests to most minds the working of coal or other fuel into domestic sizes by

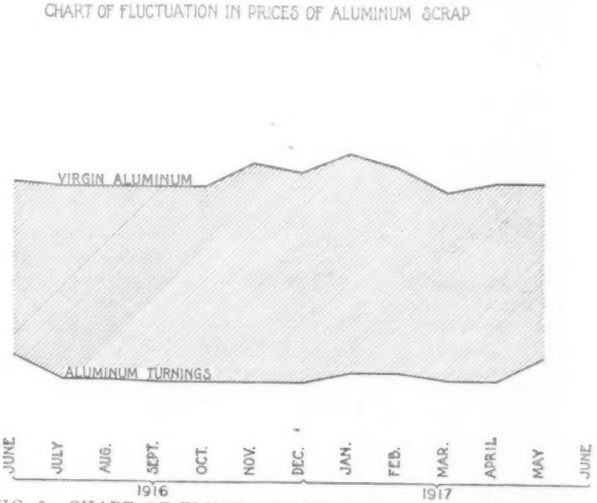

FIG. 2. CHART OF FLUCTUATIONS IN PRICES OF ALUMINUM SCRAP.

a combination of binder, treatment and molding. A comprehensive definition is really badly needed and I beg to offer the following:—"the process of fabricating small or fine materials, usually the breakage or wastage from larger blocks of the same nature, into large sizes more convenient for the purpose in hand, that purpose involving the destruction of the product or briquette as such, either by useful consumption or as a step in a melting or reducing operation."

In the manufacture of metal briquettes for the melt, it is generally advisable that no binder be used unless the binding material is in the nature of a flux. Binders, however apparently harmless in themselves, too often introduce metallurgical complexities in the final product. In all metal briquetting it is considered desirable to achieve the desired results through the medium of pressure alone.

When heavy, slow pressure is applied to metal particles or chips, a condition arises exactly analogous to the natural formation of sandstone or conglomerate rocks in nature. Rocks formed from sand and like fine materials are of two sorts—those formed by pressure alone and those cemented by a natural binding material, or chemical action. It is from the first variety that we draw our analogy.

Fine materials, whether rock particles or metal chips, show characteristic strains under compression. In some cases but little pressure is necessary to obtain distortion and consequent flow. The malleable metals, notably lead, under compression change shape. The surfaces soften and adhere together as particles of ice adhere when held together. This is a principle applying to but few types of metal or rock particles. Lead alloys and babbitt metals are consequently extremely easy to briquette. It may be said in passing, however, that it pays commercially to briquette. It may be said in passing, however, that it pays commercially to briquette this type of metal.

Copper, aluminum and their alloys, notable brass—and incidentally to a greater degree iron and steel—do not show great changes of shape under pressure other than simple bending. None the less a strong cementing action takes place between the particles under pressure heretofore explained by the term "flow," which I believe in this case to be loosely used. After the preliminary packing pressure has been exerted, whereby the metallic units are interlocked or forced against each other and the included air has been slowly expelled, the building up to extreme pressures causes a new inter-relation of the particles, a strong bond of adhesion, resulting in a briquette that is so strong, so homogeneous that it is frequently accepted as the metallurgical equivalent of heavy scrap. We know that the little heat generated is insufficient to cause binding through the medium of melting. We know that in the brasses, aluminum alloys and the like there is not the pressure flow characteristic of the more malleable metals—for even minute surface imperfections are not greatly affected. What then causes the bond, assuming that mere interlocking is insufficient?

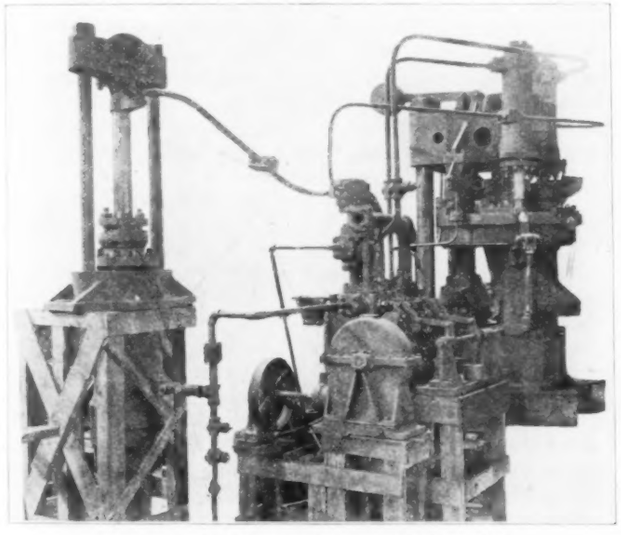

FIG. 3—PHOTOGRAPH OF A RONAY PRESS.

Materials under the strain are subject to what is known as "skin tension." Considering the outer layer of a metallic particle as the "skin" we may imagine it, under pressure, to be subjected to strains within and without which will cause alternating minute stretch and contraction, with or without fissility. Two such surfaces in contact will show a tendency to merge into each other. If microscopic cracks or fissures occur it is reasonable to assume that the bonding action is heightened thereby. This "skin tension" is offered as an explanation of the bonding that unquestionably occurs without change of shape. It is not "flow," as such, but may be regarded as the preliminary symptom of flow.

It is true, too, that with very hard steels and even in some bronzes, the very high pressures today realized are insufficient to produce even the slight skin tension necessary for bond, and in these cases it is the practice to use a binding material to assist the action. In the case of hard bronze, milk of lime has proven satisfactory as an aid to briquette making.

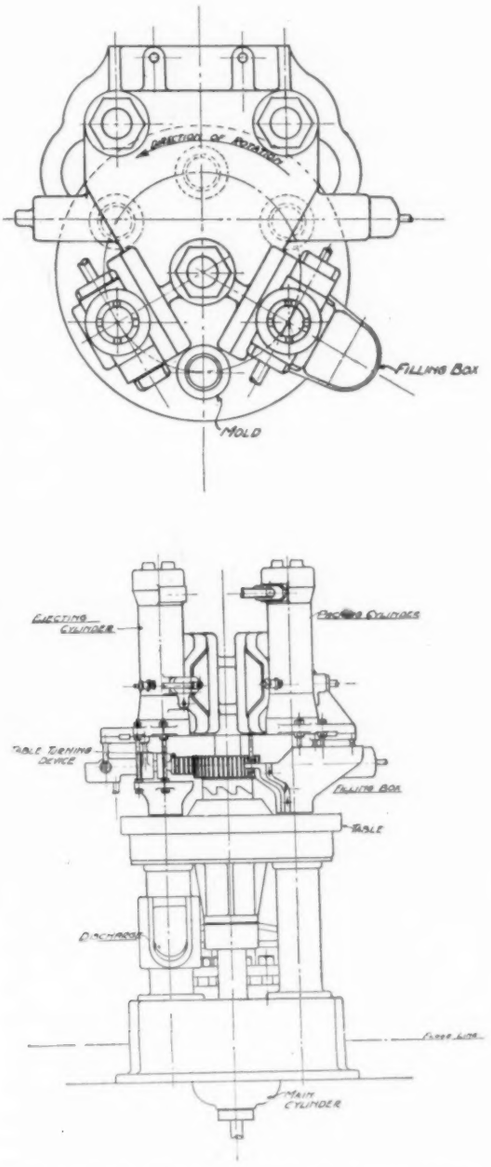

FIG. 4—PLAN AND ELEVATION OF RONAY PRESS.

Of first importance in the manufacture of metal briquettes, is the expulsion of the air surrounding the loose chips. Sudden application of force, impact by hammer blow or explosion, will not make briquettes suitable for melting because the sudden force gives no opportunity for the escape of air. Briquettes have thus been made all too frequently in the past. They contain minute chambers of air under high compression.

bers of air under high compression. In melting this air breaks out, rending and tearing, and the very least damage to be expected is the reduction of the briquette to its original state, thereby forfeiting all the economy anticipated. Were it not for this difficulty, briquettes could be successfully made by a pile driver. The usual method comprises some adaptation of the hydraulic press.

An ordinary hydraulic press can be used to make successful briquettes, provided it is operated slowly, as shown before, to get rid of included air. The result is usually a sacrifice of capacity and consequent expense. The few who have attempted commercial briquetting in ordinary hydraulic presses are gradually abandoning it. Special design is necessary to obtain simultaneously high capacity and quality of product.

Some progressive firms, notably the Lunkenheimer Company of Cincinnati and the J. L. Mott Iron Works of Trenton, N. J., have presses especially designed to handle their chips, which are working satisfactorily. Latterly there has been a tendency to adopt foreign practice.

In Europe the necessity for conserving resources has been a problem far more pressing than in the United States for a great many years. So far as study and investigation proceeded, the result may be said to be standard briquettes of all classes of metals which are daily quoted as a market commodity. The problem has been solved in many ways; but the most successful and indeed the one system originating abroad that has made a definite progress in this country is the Ronay process. Here the problems solved may be summarized as follows: the pressure is brought to the maximum commercially permissible—the capacity is high and the cost per ton extremely low. The system has been adopted at the Chase Metal Works and the Scovil Manufacturing Company, both of Waterbury, Conn., and the vast interest shown throughout the country in the presses seems to guarantee its widespread adoption in the immediate future.

The photograph illustrates the large size vertical Ronay press manufactured by the General Briquetting Company, 25 Broad Street, New York City, under the name "Type A." The sketch shows the plan and elevation of the design. Briefly it consists of six molds 5 or 6 inches as may be required set in the horizontal rotary table. This table is automatically rotated, one-sixth revolution between each operation. The operation is controlled by the automatic hydraulic valve gear.

In the operation, three molds are simultaneously subject to different operations while the other three are idle. The succeeding operation brings these three idle molds under the three pistons. Briquettes are turned out on every one-sixth revolution of the table. In the first sector the mold is filled by gravity from a filling hopper and subjected to the action of a hydraulic packing plunger working from above in the center of the hopper.

Imagining the machine in operation immediately after the filling and packing is completed, a one-sixth revolution of the table brings the mold to the idle position where it waits the filling of the succeeding mold. This complete, another one-sixth revolution brings it to the heavy pressure piston. The mold is directly under a stationary counterplunger and over a sliding plunger operated by a hydraulic piston. Pressure at the rate previously calculated is admitted by valve gear to the hydraulic piston. The lower plunger is forced against the chips in the mold. Under compression the mold rises thereby avoiding friction of the chips against its sides and causing the counterplunger to exert a pressure practically equivalent to that of the lower plunger, causing compression of the chips on both sides. To prevent inclusion of air a downward pressure is exerted against the mold by adjustment of counterweights to obtain a difference of pressure between upper and lower plungers whereby the contained air escapes from the top. The counterweights prevent too rapid rising of the mold and the maintenance of the proper differential of pressure. The counterpressure is regulated in accordance with the character of the material briquetted.

The increase in hydraulic pressure is not continuous as a slight decrease in pressure takes place with each stroke of the pump. Here the weight of the mold overcomes somewhat the frictional resistance and the mold recedes slightly. The lifting of the mold is therefore somewhat spasmodic, resulting in a movement like shaking, facilitating the expulsion of the air from the material.

With the expulsion of the air the pressure is brought up to maximum which in the 5″ molds amounts to 33,000 pounds per square inch. Pressure is held just long enough to insure a permanent set to the briquette, which is now completely formed.

The valve gear, admitting the pressure, consists of vertical poppett valves in pairs. Vertical rods attached to rockers on a cam shaft raise the valves from their seats. The shaft is rocked by a cam movement, the timing of the opening being determined by the shape of the cam and by the clearance between the lifting rods and lower ends of the valves. The valve gear first admits water from the accumulator to the pressing plunger. The next pressure is obtained by admitting water from the low pressure intensifier and the highest pressure from the high pressure intensifier. The valves lift slowly causing the proper gradual rise in the cylinder. Valve gear adjustment may be made

(1) Through the operating cam.
(2) By advancing or retarding the cam in angular position.
(3) By varying the length of the lifting rods.

The pressure is removed and another one-sixth turn brings the mold to the idle position. Thence another one-sixth turn brings the mold containing the finished briquette to the ejection plunger, also hydraulically operated. From this point another one-sixth turn brings the empty mold to an idle position, preliminary to the next position where the revolution having been completed it is again under the feeding hopper. It is seen that the three operations of feeding (with packing plunger), pressing and ejection take place simultaneously with three different molds, the other three being in intermediate positions waiting the same operations.

This press is designed to turn out four briquettes per minute. That is, the table is designed to complete forty revolutions per hour. The question of tonnage capacity depends entirely upon the character of material fed into the hopper. Loose, fluffy stuff is difficult to feed and considerable air space is left in the mold prior to the preliminary packing operation. Briquettes of this material are sometimes but 1½ to 2 inches high. This condition, fortunately exceptionally rare, would bring the machine down to a little over a ton per hour. The finer material feeds tonnage more readily, and the briquettes as high as forty pounds apiece can easily be made—representing a capacity of a little less than five tons per hour. In general, expressed in terms of brass, two tons per hour may be regarded as an extremely conservative estimate and for aluminum it would of course be lower due to its lightness.

The labor required depends upon the degree to which automatic operation is carried. If the material is fine and uniform, automatic feeding is practised. Usually, however, one man is necessary to watch the feeding and

operation of the machines. If a conveyor is installed the delivery of finished briquettes is perfectly automatic; if not, another man is required to remove and pile briquettes. A first class mechanic should be able to give part time to this machine, but the entire time of a skilled artisan is not required.

This type of press just described is of such a capacity that it is adapted particularly to the needs of the larger foundries and metal industries, the scrap dealers handling a large tonnage and custom plants where several interested parties unite on a single briquetting installation.

Many of the foundries and metal industries, however, would prefer a smaller size press with small capacity even if the cost of operations per ton were higher. It was found inexpedient to design smaller sizes of the Ronay press, vertical type, consequently a horizontal type was worked out, involving in the main the particulars of the large press, by Thomas Gilmore, Jr., Chief Engineer of the General Briquetting Company. At present there are

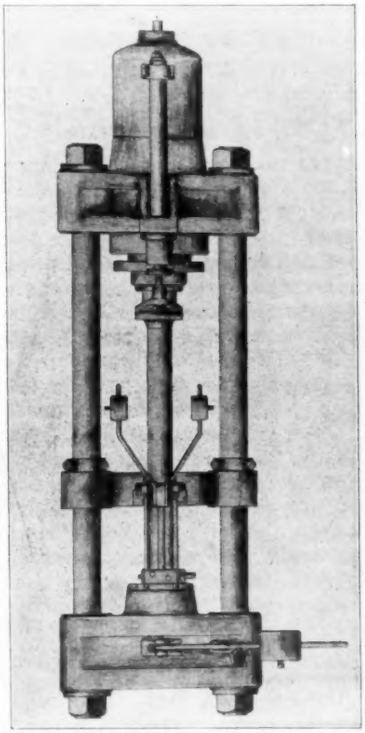

FIG. 5—PHOTOGRAPH OF "B" PRESS.

two sizes, "B" and "C," the "C" press being the smaller. However, a description of the "B" press will be ample to cover both presses. We show herewith a photograph of the press.

Mr. Gilmore's own description of this press is as follows:

DESCRIPTION TYPE "B" PRESS.—This press is of a two post horizontal construction. The cylinder end is of steel, outside packed, and designed for 4,000 pounds per square inch hydraulic pressure on a 13½" diameter plunger.

Two pull-back pistons, outside packed, are connected to the main plunger by means of a cross-head.

The head block of steel contains the mold which is also of steel bushed with hard iron; this mold has a 6" bore and is 12" long. A removable block located in the head block at the discharge end of the mold serves to close one end of this mold when forming a briquette. A receiving hopper at the inside end of this mold is 6" wide x 24" long, provided with a hinged cover, which, when the hopper is filled with turnings, is closed and locked, forming a cylindrical retort for the turnings. The ram entering at the rear end of this cylinder thrusts the clips into the mold and ultimately forms a briquette therein. When the briquette is formed and the pressure has been released, the block is removed and by again applying pressure the briquette is removed.

A belt driven sextuplex pump is provided, having low pressure cylinders of 8.7 gallons per minute capacity at 1,000 lbs. per square inch pressure, and high pressure cylinders of 4.9 per minute capacity at 4,000 lbs. per square inch pressure. This pump is provided with a combination check, also a check valve which closes at 1,000 lbs. line pressure, a 1,000 lb. relief valve for the high pressure pump, both of which are simply emergency valves.

Suitable air bottles of 8 cubic feet or more capacity are provided. These bottles serve the purpose of an accumulator and are more efficient of under a pressure of 100 lbs. per square inch or more of air when no water is contained.

An automatic relief valve by-passes the low pressure pump freely when a pressure of 1,000 lbs. has been attained in the air bottles. A 1,000 lb. spring relief valve by-passes the valve if the valve is not open.

The operating valves are controlled by a single operating lever.

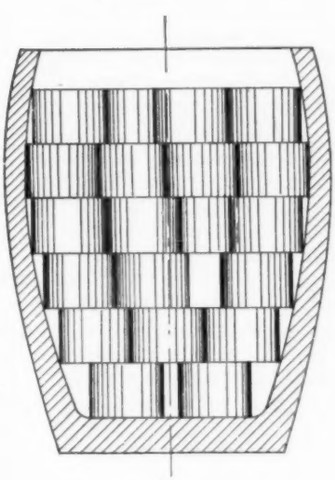

FIG. 6.

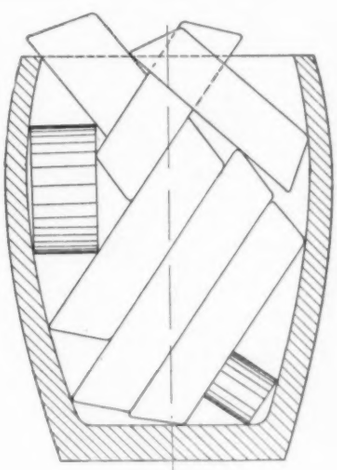

FIG. 7.

FIG. 6—A CHARGE OF BRIQUETTES IN THE CRUCIBLE.
FIG. 7—A CHARGE OF HEAVY SCRAP.

The cycle of operation of the press is as follows:

POSITION 1: The high pressure pump is by-passing freely through a valve, and the lower pressure pump is discharging freely through the automatic relief valve which is held open by the air bottle pressure. Having charged the receiving hopper, and clamped the cover, the lever is advanced to

POSITION 3: The air bottles discharge to the press cylinder until the pressures balance.

POSITION 2: The valve is closed and the low and high pressure pumps continue to build up pressure on the press cylinder until about 1,000 lbs. pressure is reached when the 1,000 lb. check valve closes, cutting off the low pressure pump which by-passes to the air bottles unless the operator again moves to

POSITION 3: Thus the low pressure pump builds up the air bottle pressure while the high pressure pump is building up pressure in the main cylinder.

When the air bottle pressure reaches approximately 1,000 lbs. the automatic relief valve opens and the low pressure by-passes freely.

POSITION 1: Having built up the desired pressure on the briquette the pressure is momentarily relieved while moving the block preparatory for ejecting the briquette.

POSITION 3: For ejecting the briquette.

POSITION 1: Neutral, previously described.

Now that we have covered the necessity for economies in the treatment of light scrap and the method of manufacture of briquettes, it only remains to consider the behavior of the briquettes in the crucibles.

The briquettes made by this process show a density of about 75 to 80 per cent that of ingot metal. This deficiency in density, as compared with heavy scrap, is made up by the fact that the briquettes, pack, because of their shape, much more compactly into the crucible, and therefore a larger amount of actual metal is on hand for treatment. The sketches herewith shown depict this. It will be noted that, because of irregularity of shape, the heavy scrap allows a greater amount of air space in the charge.

It is not my intention to submit a vast amount of tests and figures to prove the contention that briquettes are a strong feature for economy. However, a test run on manganese bronze chips at the American Manganese Bronze Company's plant in Philadelphia shows a very surprising and gratifying result. It is herewith attached.

It will be noted at present prices the economy effected, on saving in oxidation and vaporization alone, will approach $50 per ton irrespective of the time saved in melting. Add to this the greater ease in handling and charging and it will be understood that a great advance has been made.

In the case of aluminum, the sub-joined test shows a saving of 5.6 per cent, which may be regarded as the very least to be made. This, however, represents at least $40 per ton.

	Aluminum Chips Loose	Aluminum Chips Briquetted
Charge	14.5 kg.	14.8 kg.
Melting time	50 min.	35 min.
Output	12.5 kg.	13.6 kg.
Melting loss	2 kg.	1.2 kg.
Melting loss—in percentage	13.8	8.1

Two per cent. ammonium chloride added to briquettes as flux.

TEST OF RESULTANT METAL.

Mark of test bar	1 Chips	1 Chips	11 Briquettes	11 Briquettes
Bar dimensions mm.	20.6x5.8	20.3x5.3	20.4x5.2	20.3x5.3
Distance between test points mm.	120	120	120	120
Cross section qmm.	119.5	107.5	106	107.5
Elongation mm.	0.8	0.8	1.2	1.0
Ultimate strength kg.	2520	2120	2850	2800
Unit ultimate strength qmm. kg.	21.5	19.7	26.9	26.0
Per cent. elongation.	0.65	0.65	1.0	0.83

Note, too, that the metal obtained from the briquettes is vastly superior to the product of the melted borings. It must be stated, however, that briquetting is not a haphazard affair. It is a new and important science and specialty calling for engineering experts. The experts must be qualified to pass upon proper method of briquetting any fine material and the economies thereby to be realized. A great future is evidently predicted for this new branch of Engineering Science.

MELTING TESTS WITH MANGANESE BRONZE CHIPS AND MANGANESE BRONZE CHIP BRIQUETTES MADE AT THE AMERICAN MANGANESE BRONZE COMPANY, HOLMESBURG, PA. (MARCH 26-27, 1917.)

Material Charged	Pounds	Test Started	Crucible Taken Out	Melting Time	Loss in Melting
Manganese bronze chips—loose (See Note)	727	1.00 p. m.	5.20 p. m.	4 hours 20 min.	137 lbs. 18.8%
Manganese bronze chip briquettes	727	1.55 p. m.	5.40 p. m.	3 hours 45 min.	62 lbs. 8.5%
Manganese bronze chips—loose	727	8.30 a. m.	1.00 p. m.	4 hours 30 min.	164 lbs. 22.5%

Kind of furnaces: Common crucible furnaces with natural draft.
Kind of fuel: Hard melting coke.
Note: Some flux of unknown composition used.

ETCHING AGENTS.

A NOTE ON THE USE OF CHROMIC ACID AND HYDROGEN PEROXIDE.

BY S. W. MILLER (ROCHESTER, N. Y.).

In the course of recent correspondence, Mr. S. W. Miller, of Rochester, N. Y., has communicated to the secretary an account of his method of using a mixture of chromic acid and hydrogen peroxide as a reagent for etching brass and bronze, and has expressed a desire that his experience should be placed at the disposal of those interested in the subject. The substance of Mr. Miller's information has been arranged by Dr. O. F. Hudson in the form of this Note.

A dilute solution of chromic acid is used, to which a few drops of hydrogen peroxide are added. The specimen is immersed and kept moving in the solution for a few seconds. It is then removed and washed immediately in running water. Originally, Mr. Miller used concentrated chromic acid diluted with an equal bulk of water, and to a small quantity of this solution the hydrogen peroxide was added. Later he found that acid of this strength was too strong, and that he had been using too weak a solution of hydrogen peroxide.

Only a few drops, say six or eight, of chromic acid are necessary, and to this dilute solution a few drops of hydrogen peroxide, which should not be too weak, are added.

The addition of the hydrogen peroxide causes a strong effervescence, and turns the solution of chromic acid a very dark green. If the chromic acid solution is too strong large gas bubbles are evolved, which prevent uniform etching. When, however, the right strength of acid is used, the immersion of the specimen causes a spitting of the liquid, particles of which are projected from the bath on to the sides of the containing vessel.

Mr. Miller states that he finds this reagent equally satisfactory for all brasses and bronzes, and that it is the best of all the reagents for this purpose that he has tried, giving much better results than chromic acid alone. In the case of tin-copper alloys the α is not stained, while the δ remains a light blue. Similarly, in the copper alloys, both the α and β are said not to be changed in color, while in rolled brass the grain boundaries and twin crystals are brought out with great clearness. This reagent has also been found to give good results when used as an etching agent for silver.—British Institute of Metals, September, 1917, meeting.

NEGATIVE EXPERIMENTS ON WASTE CORE SAND

A Paper Presented at the Meeting of American Institute of Metals, Held at Boston, Mass., September 24-28, 1917.

By H. W. Gillett and E. L. Mack, Department of Interior, Bureau of Mines, Washington, D. C.

(Concluded from November)

STRENGTH TESTS

Cores were made from the various samples, the sand having been first dried out at 100° C. (212°F.). In all cases 10 per cent water by volume was used. A pure linseed oil was used as binder. The cores were rammed up in a standard cement briquette mold giving a core of 1 square inch breaking section. The hardness of ramming was tested from time to time by weighing the briquette.

The sand, oil and water were carefully measured out (all mixtures being by volume) and mixed by rubbing between the hands. Since the thoroughness of mixing is a prime factor, and the least easily controlled variable, great care was taken to mix thoroughly. The cores were placed in a small electric oven which would hold only eight cores. The oven was brought up to 204° C. (400° F.) in 1½ to 2 hours and held at 204° C. ± 4° for 1½ hours (save in one run when the power went off and the baking time was 1¼ hours). The power was then cut off and the door opened and the cores removed when nearly cold. A current of air was run into the bottom of the oven and out at the top. The air was run through a wash bottle containing water, to allow using a constant air supply and to saturate the air with moisture at room temperature. The cores were broken in a small Fairbanks cement testing machine loaded at 200 pounds per minute. In each run, one or two standard cores, half Rochester, half Lake sand by volume, 10 per cent water by volume, 2 per cent oil by volume, were baked.

The strength of the cores, for various ratios of oil to sand, all baked 90 minutes at 400° F. (204° C.) unless noted, and all with 10 per cent water by volume, is given in the table.

For truly dependable results, dozens of cores should be used and the average taken for each test. The smallness of the oven, and the small supply of sand prevented the making of more than one or two cores on each test. However, any given series is usually consistent, and where duplicates were run, they agreed pretty well. One cannot draw final conclusions from these isolated tests, though they ought to give tentative general indications.

Comparing the strength tests, it is seen that the burnt sand is much weaker than the standard, and that this is most notable at low oil ratios. Igniting the burnt sand to free it from carbon gives a still weaker core than the burnt sand alone. Thirty per cent of burnt or ignited burnt sand, with 40 Rochester, 40 Lake, to give a sieve test close to the standard, gives too weak a core, and the excess oil needed by a given weight of burnt sand when mixed with 70 per cent other sand is greater than with all burnt sand. The tests on 30 per cent ignited burnt plus 70 per cent other sand show less reduction in strength, but the standard cores baked with that lot are exceptionally strong.

Igniting the standard 50 Rochester, 50 Lake mixture even to 475° C. gives a great decrease in strength. The cause of the low strength of burnt sand does not seem to be free lime, as titration showed no great difference between ignited burnt and standard, and washing with HCl did not increase the strength. Since ignition so greatly affects the standard sand, it seems likely that the weakening of the burnt sand is due not only to the carbon coating but also to a change in the surface of the grains by sintering.

It is the impression of the writers that the castings made in the Cadillac foundry are thin-walled—*i. e.*, the metal must be poured pretty hot. The hotter the metal, the higher the burnt sand gets heated. This temperature variable may, it seems probable, be a greater cause for the poorer results found by Mr. Lane on washed Cadillac sand than on washed sand from other foundries, without the sea-coal facing.

Since the carbon coating is not readily tumbled off, no change being noted in sieve test in color or amount of fine carbon or tumbling, it can only be eliminated by burning it off. Since burning it off always makes the sand worse than the unignited burnt sand, there seems no way of getting rid of the carbon without doing still further damage. There seems to be no way of telling whether the cause of the weakness is mainly carbon, or mainly some change due to heating to a high temperature. Possibly some slight weakening comes from the admixture of molding sand. It would be interesting from the standpoint of colloid chemistry to find out just what change takes place in the sand grains on beating which so increases the oil required to give a strong core. On molding sand it is known that ignition destroys the clay bond. But clay bond is not considered desirable in a core sand, as it itself is supposed to make the sand require more oil.

Washing out most of the fine burnt sand with water gave a strong core. Water washing has in general, it is understood, given better results than air elutriation, although the latter sometimes serves. It is not known whether severe waterwashing (in the washing experiments above, 25 per cent of the total sand was washed out, but this included some coarse as well as fine, as the washing method was crude) has been tried commercially on the Cadillac sand. The single washing test would indicate a possibility of the use of that method. But so coarse a sand as resulted from that test would not be suitable for cores without addition of finer sand.

Further tests should be made on washing out fine particles, on the original burnt sand, and on it after slight grinding up, in which various proportions of the fine particles should be removed, and the oil consumption of such samples found, alone, and mixed with new sands to give the desired screen test. But as Lane's work indicated that this sand was not satisfactory even when freed from fine particles, the chances seem slim, for a commercially satisfactory washing method.

It is very likely that the burnt sand might behave differently with other binders, such as rosin, glutrin, flour, dextrin, or pitch. But whether any given foundry can use up its burnt sand from oil cores in cores made with other binders, will depend on the nature of the work in that foundry, *i. e.*, on its need for and ability to use, cores made with the cheaper binders, even if the other binders would work with burnt sand.

It is well known that burnt core sand from aluminum which of course is not heated to a very high temperature, can often be re-used without much trouble. It seems probable that, at least on some sands, the amount of injury done to the burnt core sand will be roughly pro-

Sand Sieve Test Letter	Oil Ratio	Tensile Strength Lbs. per Sq. In.	Average T. S. of Accompanying Standard Cores	Baking Time Min.
Standard 50 R., 50 L.	1:50	104 (Av. of 13 cores)	...	90
C.	1:30	181	...	90
C.	1:50	90 (Av. of 3 cores)	...	75
A—All Rochester	1:50	52	90	75
B—All Lake	1:50	132	90	75
D—All Burnt	1:10	295	93	90
All Burnt	1:15	395	93	90
All Burnt	1:20	362	93	90
All Burnt	1:25	233	93	90
All Burnt	1:30	152	108	90
All Burnt	1:35	82	93	90
All Burnt	1:40	65	108	90
All Burnt	1:50	24	93	90
E—Ignited Burnt	1:30	91	108	90
Ignited Burnt	1:35	51	108	90
Ignited Burnt	1:40	39	108	90
Ignited Burnt	1:45	34	108	90
Ignited Burnt	1:50	18	89	90
F—"Popped" Ignited Burnt	1:50	20 (Av. of 2)	94	90
G—40 Roch., 30 Lake, 30 Burnt	1:20	299	98	90
40 Roch., 30 Lake, 30 Burnt	1:30	151	98	90
40 Roch., 30 Lake, 30 Burnt	1:40	88	98	90
40 Roch., 30 Lake, 30 Burnt	1:50	58	98	90
40 Roch., 30 Lake, 30 Ignited Burnt	1:30	175	128	90
40 Roch., 30 Lake, 30 Ignited Burnt	1:35	147	128	90
40 Roch., 30 Lake, 30 Ignited Burnt	1:40	117	128	90
40 Roch., 30 Lake, 30 Ignited Burnt	1:50	77	128	90
Severely Ignited Stan. 50 R., 50 L. probably heated to 700°	1:30	162	89	90
	1:40	60	89	90
	1:50	34	89	90
L—Short Ignited Stan. 50 R., 50 L.	1:50	66 (Av. of 2)	94	90
M—Long Ignited Stan. 50 R., 50 L.	1:50	67 (Av. of 2)	94	90
Burnt, Washed with HCl	1:35	94	117	90*
Burnt, Washed with HCl	1:40	18	117	90*
Burnt, Washed with HCl	1:50	24	117	90*
Ignited, Burnt, washed with HCl	1:35	79	117	90*
Ignited, Burnt, washed with HCl	1:40	48	117	90*
Ignited, Burnt, washed with HCl	1:50	30	117	90*
Ignited, Burnt, Washed with NaOH	1:50	34	89	90†
I—Washed Tumbled Burnt	1:50	115 (Av. of 2)	90	75‡
K—Washed Tumbled Ignited Burnt	1:50	84 (Av. of 2)	90	75‡

portional to the temperature to which it has been heated.

It is distressing that the experiments given above neither gave promise for the commercial utilization of the burnt sand, nor threw light on the exact mechanism of the deterioration of such sand. It is hoped that the publication of these negative experiments will not deter others from attacking the same problem, for it must be possible either to find a way to use the burnt sand, or to so clarify the theory of what happens to the sand in burning as to make certain that such use is impossible. All these experiments can be taken to prove is that on this particular sand, it was of no avail to burn off the carbon, and that even the heating of the new sand to a comparatively low temperature, vastly increased the oil needed to give a strong core.

Acknowledgment is made to Cornell University for the use of its chemical laboratories in connection with this investigation.

CONDITIONS IN GRAPHITE INDUSTRY.

An interesting review of the war-time development of another American industry of growing importance is published by the United States Geological Survey in the form of a pamphlet by Henry G. Ferguson on the home production of graphite in 1916. Graphite, though less valuable than its sister carbon crystal, the diamond, has an even wider variety of commercial uses. Most people are probably aware that the lead pencils they use are not lead pencils at all, but graphite pencils, but few realize the immense importance of graphite in the manufacture of crucibles for the production of brass and other valuable alloys, high speed steels, &c., in paint, in lubricants, and in a wide variety of other industries.

The largest graphite mines in the world producing the best quality of mineral graphite are in Ceylon, and there are also great deposits in Mexico and Korea. But before the war the clay, with which the graphite must be combined in making crucibles, came from Bavaria, where there are also extensive graphite mines. Cut off from Ceylon, the Germans have made Bavarian graphite serve them, but on the other hand, cut off from Bavaria, American manufacturers have succeeded in developing clay beds at home that are proving capable of making crucibles as good in quality as the Bavarian ones.

In 1915 the total American mine production of amorphous (finely divided) graphite was 1,181 tons and of crystaline graphite 7,074,370 pounds. In 1916 the total of amorphous graphite was 2,622 tons, and of crystalline, 10,931,989 pounds.

*400 cc. sand washed with 500 cc. water 10 cc. HCl. HCl washed out with water, sand dried at 100° C. Sand filtered, no fine material washed out.

†Sand washed with 10 per cent. NaOH, washed, neutralized with HCl, washed free from NaCl, dried at 100° C. No fine material lost.

‡Much fine material washed out, see sieve tests.

EDITORIAL

Vol. 15 NEW YORK, DECEMBER, 1917 No. 12

THE METAL INDUSTRY

With Which Are Incorporated
THE ALUMINUM WORLD, THE BRASS FOUNDER AND FINISHER, THE ELECTRO-PLATERS' REVIEW, COPPER AND BRASS.
Published Monthly

Entered February 10, 1903, at New York, N. Y., as second class matter under Act of Congress March 3, 1879

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CONTENTS

PHOSPHORUS SHORTAGE

The present shortage of phosphorus with the subsequent increase in price (present quotation $1.70 per pound) has given rise to considerable uneasiness on the part of the metal founder. The greatest value of phosphorus in the preparation of metallic alloys lies in its deoxidizing properties. When combined in certain definite proportions with copper and tin it imparts valuable properties to the alloy. For instance, in phosphor bronze, which is really not an alloy containing a fixed quantity of copper, but is a bronze mixture of copper and tin treated with phosphor combinations, we have a resulting metal of great strength, elasticity and non-corrosive qualities. The effect of the phosphorus in this copper-tin alloy known as phosphor bronze is in a sense two-fold. In certain amounts the phosphorus is all taken up by the tin, and phosphide of tin is then considered to be present in the alloy with the copper. If larger amounts are added we have both the phosphides of tin and copper formed. By adding the large amounts of phosphorus we do not decrease the strength and toughness of the metal, but we do increase the hardness until some phosphor bronzes approach steel in their general properties.

The usual practice followed in the manufacture of this class of bronzes is to employ either phosphor copper or tin in the proper amounts to produce a mixture with the mechanical properties desired. These phosphor metals are usually made by the very wasteful process of bringing the phosphorus in contact with the molten metal with the resultant loss of at least fifty per cent of the phosphorus used. Perhaps now, with the metalloid scarce and a tariff of one dollar and seventy cents per pound tacked on, metal founders who have occasion to make use of phosphorus for this purpose may be interested in a formula we published in THE METAL INDUSTRY for August, 1917, which has given excellent results in making as high as fourteen per cent phosphor copper. This formula, to make convenient to any one interested we will now repeat. It is as follows:

Mix together thoroughly 60 pounds of calcium superphosphate, 30 pounds of granulated copper and 10 parts of finely ground coal free from sulphur. Put into a crucible, lute on a cover and heat gradually until the melting point of copper has been attained. Care must be taken not to overheat the mixture. The phosphor copper settles out at the bottom of the crucible and may be poured into open iron molds. By the above process no expensive phosphorus that is half wasted is used, and the resulting phosphor metal is sure to be uniform in its phosphor content.

Another method by which phosphor bronze is prepared, is to use a crucible lined up with a mixture of 18 parts of bone ash (Ca_3 (PO_4) $_2$), 14 parts of sand and 4 parts of charcoal; the whole ground up with a little silicate of sodium mixture (1 of silicate to 9 of water). Copper in shot or granulated form is introduced into the crucible alternated with layers of the above mixture and heated to the temperature of molten copper. The products of this reaction rise to the surface and are skimmed off as a slag which consists almost entirely of lime or calcium carbonate.

Another form in which phosphorus is used in the foundry is for the sole purpose of a deoxidizer, and fortunately there are a number of metals which are available to the metal melter which will perform the same office and are cheaper and more economical. We have on several occasions laid stress on the dangers attending the use of phosphorus, so it is not necessary to repeat these warnings here. Perhaps it will be just as well if the dangerous metalloid is taken perforce from the everyday foundry supply list and is utilized only in those lines where its danger is realized and it is consequently handled with the requisite care.

Phosphorus is used in deoxidizing copper where sound castings are desired, but great care is necessary when using it as an overdose will produce results worse than if none had been used at all. The best way to treat copper intended for electrical purposes is, when melted in large quantities, to stir or pole with a stick of wood, as is done at the copper refinery. When melted in small units, as in crucibles, there are several metals that can be advantageously used. The first of these is magnesium, which now can be obtained as a copper-magnesium alloy and in amounts as high as .2 per cent does not effect conductivity, while silicon may be had as silicon-copper, and can be present in amounts as high as .05 per cent.

For purposes where the electrical conductivity does not constitute an important factor there are a number of compounds and metals which can be used with good effect. Among these are cuprous chloride—ammonium chloride, argolls (crude tartrate of potassium), tin, zinc, manganese and aluminum. It is well to remind metal mixers, however, that care is necessary in the administering of all of these "medicines," as sometimes the cure is worse than the malady. When chemical supervision is possible it should be exercised, and if possible to melt copper in large enough quantities the "poling" process is by far the best, safest and cheapest.

It will be seen, therefore, from the foregoing that the foundryman need not be worried because of the scarcity of phosphorus, for he has lots of ways out if he cannot get it, and in a great many cases he is better off without it.

CORRESPONDENCE AND DISCUSSION

WE CORDIALLY INVITE CRITICISMS OF ARTICLES PUBLISHED IN THE METAL INDUSTRY

THE BEST CLEANER

To the Editor of THE METAL INDUSTRY:

In removing oils and grease from any surface it is best to take into consideration the kind of material to be removed, the metal to be cleaned, temperature, concentration of cleaning solution and whether electric current is to be utilized. For instance, the cleaner containing a large percentage of sodium or potassium hydroxide might work entirely satisfactorily for the individual cleaning of iron or steel, but would be entirely out of the question where aluminum zinc and other alloys are to be cleaned.

Again some of the oils and greases readily form soaps which others need the addition of some agent to the cleaner to assist this formation. Concentration of the cleaning agent is also of importance. A cleaner must be of such material as to remove the foreign bodies and still not tarnish the base metal. Then again we have the binders used in some polishing compounds which are not affected by the cleaning agent but float upon a hot solution and when the work is taken out of such a solution this material again covers the work with an invisible film and causes the plate to peel.

So it will be seen that one must look into the cleaning problem if the plater intends to make his own cleaner. While on the other hand, a good cleaner may be purchased and made up for about 2½ to 3½ cents per gallon, if the individual wishes to purchase such salts already prepared.

New York, November 27, 1917. WILLIAM VOSS.

NEW BOOKS

Thomas' Register of American Manufacturers. Compiled by the Thomas Publishing Company. Size 9 x 12 inches. 3,900 pages. Bound in boards. Price $10.00. For sale by THE METAL INDUSTRY.

This book is the ninth edition of this valuable and important publication. The revisions, new matter and improvements required 400 additional pages, bringing the total contents up to 3,900 and makes it the largest publication of its kind ever issued. The Thomas' Register is the guide to United States sources of supply for all buyers, either domestic or foreign, and it is stated by the publishers that more than 10,000 copies are now in use by concerns; representing more than forty per cent. of the total capital invested in merchandising and manufacturing in the United States.

The book also furnishes valuable mailing lists of all the manufacturers in any line at a small fraction of the cost of obtaining such lists elsewhere. The book is made up of three main sections, the first of which classifies manufacturers according to the name of article made; the second, lists the manufacturers by names and addresses; while the third lists all of the popular trade names in alphabetical order.

Viewing the advantages of this work as a whole it is apparent that no progressive business house can afford to be without it.

Mechanical Processes. By G. W. Danforth, U. S. Navy. Size 6½ x 9½ inches. Bound in cloth. 420 pages including index. 270 illustrations, with numerous tables. Published by the United States Naval Institute, 1917.

This book, which has just been revised, is used as a text book by midshipmen of the Navy Yard at Annapolis. It is intended as an elementary account of the several classes of processes employed in shaping materials of construction for various mechanical uses. A brief account of the properties of these materials and of the methods of producing them is also given.

Much of the subject matter is taken from notes of the writer made when on engineering instruction, on shipyard inspection and other engineering duty. These notes were in several instances checked and supplemented by information from various technical books and papers, particularly by reference to their reports of original investigations.

This work, which is the second edition, contains thirteen chapters and an appendix. The subject matter treated in these chapters include the following: engineering materials, a general outline of metal-producing processes, fuels, iron and steel, mechanical treatment of metals—heat treatment of metals, the re-manufacture of metals, shops of machinery building and repairing plants—drawings for shop use, the pattern shop, the foundry, the blacksmith shop, the machine shop, the boiler shop and other shops.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ASSOCIATE EDITORS: JESSE L. JONES, Metallurgical PETER W. BLAIR, Mechanical CHARLES H. PROCTOR Plating-Chemical

BEARINGS

Q.—I should be glad if you would give me the proper mixture for making electric motor bearings. We run six 5 to 7 h.-p., and have great difficulty at the moment in getting bearings replaced when worn; we also have our own brass casting department and every means of making these ourselves, but lack the proper alloy.

A.—The alloy which should prove suitable for your purpose is as follows:

Copper	87 parts
Zinc	3 "
Tin	7 "
Lead	3 "

—W. T. F. Problem 2,511.

CASTING

Q.—I have some castings to make in brass, aluminum, etc., for instrument work. They must have good, sound, smooth faces, so that after being cleaned, and without being filed or machined, they are ready for spraying with a kind of paint lacquer. We are using the usual Mansfield sand. Dusting with flour gives a good surface, I believe, but this is now out of the question. I have the best highly varnished patterns that can be made, and I want the castings to be as near perfect as possible. Have also the means of lightly drying the molds.

A.—If flour is not obtainable, use very finely divided pea flour, dusting onto the mold surface, which should be of fine sand. An addition of 20 per cent. floury plumbago may be added to the pea flour with advantage. An alternative method would be to use a liquid carbon facing (fine charcoal or plumbago) and paint it on to the mold surface, afterwards drying the surface lightly in front of a stove.—W. T. F. Problem 2,512.

DIPPING

Q.—Will you give us information regarding a silver finish obtained by ordinary dipping or a French gray finish?

A.—For silvering by immersion use either of the following formulas:

1.

Water	1 gallon
Silver cyanide	½ ounce
Sodium cyanide	1 ounce
Caustic soda in sticks	¼ ounce

2.

Water	1 gallon
Silver Trisalyt	1 ounce
Sodium cyanide	¾ ounce
Caustic soda in sticks	¼ ounce

The temperature of both the solutions should be 100 to 120 degrees Fahr. Prepare them by first dissolving the cyanide in a small part of the total amount of water, then add the silver salts, thoroughly mix them, then add the balance of the water and finally the caustic soda.

It is impossible to produce a French gray by simple immersion, but if you desire a grayish tone to the silver prepare a dip as follows:

Water	1 gallon
Sodium arsenate	8 ounces
Sodium cyanide	6 ounces

Use the solution at 180 degrees Fahr. It may be necessary to increase the cyanide content to 9 ounces or more per gallon. If the gray tone develops slowly, then add the increased amount of cyanide as given in small proportions until satisfactory results are obtained.—C. H. P. Problem 2,513.

FINISHING

Q.—How is it possible to obtain a hard gold finish on watch cases that will stand buffing and that will wear well?

A.—To produce a hard gold finish suitable for watch cases it will be necessary to add nickel to your gold solution. Nickel can be added in the form of a nickel cyanide dissolved in an equal amount of sodium cyanide, and then small proportions added to the gold bath to produce a hard finish. A gold and nickel anode should be used, approximating 1 to 2 parts of nickel and the balance fine gold. A nickel-gold salt can be obtained, which contains 22 parts of fine gold and 2 parts of nickel.—C. H. P. Problem 2,514.

MELTING

Q.—We have on hand a quantity of brass 63-37 and would appreciate any information you can give us regarding the proper amount of lead or other alloy to be used in melting in order to get good results as to swedging, stamping, rolling and obtain fairly good turning qualities. As the stock is now it turns too hard.

A.—We would not advise you to add lead to your brass mixture if you wish to do the things with it that you mention. Lead imparts a quality to brass that does not admit of swedging and stamping with impunity if your finished articles are to be at all thin. What you require is a tougher mixture than you have and we would advise you to add some copper to your metal which will give the desirable mechanical properties. A mixture of 65 to 68 copper and the balance spelter will give admirable results. If you wish to make the metal free turning it would be necessary to you to add 1½ per cent. of lead.—K. Problem 2,515.

MIXING

Q.—I wish a mixture for a form to make reliners for automobile tires. A white metal that is not too hard nor too soft is wanted. Aluminum is too expensive. The castings will weigh possibly two pounds. What do you think of the following mixtures? Would they be expensive? Lead, 6 parts; antimony, 4 drachms, or antimony, 2 parts; brass, 8 parts; bismuth, 6 ounces, and tin, 10 parts.

A.—The first mixture you name, in parts per hundred, would be about: lead, 92.3 per cent.; antimony, 7.7 per cent. This mixture is cheap and rather soft, but it may answer your purpose.

The second mixture gives: tin, 54.42 per cent.; copper, 17.42 per cent.; zinc, 15.24 per cent.; antimony, 10.85 per cent.; bismuth, 2.07 per cent. This mixture is rather expensive and it would no doubt be too hard and brittle to be of any value.

The following mixture has proved to be a very satisfactory pattern metal: tin, 50 parts; zinc, 50 parts. It is tough, fairly hard and casts well in sand.

Where forms are of such a nature that they can be shaped from a plastic material, zinc dross from the hot galvanizing process may be used. It has the advantage of great cheapness.—J. L. J. Problem 2,516.

Q.—In making a cheap composition of copper, zinc and tin, say 60-35-5, what bearing on the mixture does the zinc have? In adding zinc to the mixture, does it harden or soften it? What effect does tin have on a composition? Does tin harden the mixture or strengthen it? If we want to make a cheap competitive composition metal, what would we add to this mixture to make it hard and strong to be used for bearings or gears?

A.—The mixture you name—copper 60, zinc 35 and tin 5—is in the region of the rolling rather than the sand-casting brasses. Rolling mixtures are not suited to the making of sand castings.

The writer considers that a mixture of copper 76, tin 3, lead 3, and zinc 18 is about as low in copper and tin as is economical to use, everything considered; especially if light castings are to be made from it. The rolling alloys are soft, tough and not very fluid. They do not machine readily in the unwrought form and tear if cut at a high speed. An increase of the tin will harden, give fluidity and better casting qualities and also increase the strength of the mixture. The addition of lead will enable the castings to be readily machined.

The standard mixture for bearings is copper 80, tin 10, lead 10 and phosphorus .35. You could not, of course, use scrap brass or composition in making such a mixture because of the zinc they contain. For gears use copper 92½, tin 7½ and phosphorus .35. If much more tin or phosphorus is used than this, difficulty will be had in machining the gears.

A mixture of 40 per cent. sheet yellow brass and 60 per cent. good composition will give you approximately the 76-3-3-18 alloy recommended above. By adding 10 pounds of tin and 100 pounds of copper you will obtain a mixture that might possibly be used for bearings and gears, although it would not be much harder than the composition metal used as one of the components in making it.—J. L. J. Problem 2,517.

PICKLING

Q.—We are annealing with oil and large discs, 5¾ inches to 6 inches in diameter and ⅜ inch thick are, and must be blanked hard, then piled six high on a pan and pulled in and annealed, which takes about one hour and thirty minutes. The trouble we are experiencing starts when we put them into the pickle which we hold at 38 degrees Baumé and then into cold water, and then into hot water and sawdust. When they come from the pickle into the cold water they are covered with a black scum, which is loosened on the discs but won't come off unless we take a rag and wipe it. Then our discs do not come out nice and clean and bright on the top and especially on the edges. Can you tell us what to do to our pickle to remove this black scum?

We have a suspicion that the black deposit is caused by the high sulphur contents in the oil. Would this be possible, or if not what could there be in the oil to do this?

A.—Unless you are using a very low grade oil and not sufficient air in your blast we do not believe the black scum you speak of is caused by the sulphur in the oil. The Mexican crude oil contains about 2½ per cent. of sulphur and even this would not be sufficient even under the worst possible operating conditions to form anything like a thick scum on annealed metal.

What we suspect is the trouble is that the pickling solution is not as it should be and you are really not pickling off the oxides which are legitimately formed on the brass. A pickle which stands at 38 degrees Baumé is evidently heavily charged with sulphates of copper and zinc and has lost its pickling ability. We would suggest that you use a pickling solution standing at about 12 to 14 degrees Baumé and we believe that you will find that your discs will come out clean.

If they do not come out clean with the above pickle you will have to look to your annealing conditions as it is possible not enough air is supplied to the furnace with the oil and you may have too heavy a reducing condition. The point is rather delicately adjusted but is readily found by experience which will give just enough of a reducing action to soften the metal and prevent any oxidation and burning out of the spelter.—K. Problem 2,518.

POLISHING

Q.—We are very anxious to make a very fast cutting tripoli composition for polishing sheet aluminum goods. We have tried several grades and makes of this material but not with very satisfactory results and would like to know the formula for a good tripoli composition.

A.—You cannot manufacture a tripoli composition as cheap as it can be purchased. We would suggest trying a composition made up from a mixture of tripoli and silex. This composition would cut faster. An emery paste composition is also used quite extensively in polishing aluminum. Tripoli compositions glaze over quickly when applied to the polishing wheel, while emery pastes are more greasy and do not glaze. We would suggest applying a little kerosene oil with the tripoli composition as the kerosene oil prevents glazing and therefore the tripoli will cut faster.—C. H. P. Problem 2,519.

PLATING

Q.—Can you advise us in reference to the voltage and amperage most suitable for copper deposits by the acid solution on non-metallics? What voltage do you consider best at the tank and about what amperate per square foot?

A.—The voltage of an acid copper solution for use on non-metallics is about 1 volt and the amperate about 20 per square foot is the maximum amount. To obtain the best results the solution should be kept at a uniform normal temperature of about 70 degrees Fahr.—C. H. P. Problem 2,520.

POURING

Q.—We are having trouble pouring bronze and white metal bushings, both cored and solid. It seems to be hard work to eliminate blow-holes and when the bushings are machined, being porous they are very unsatisfactory. Will you kindly advise us fully as to how to get satisfactory results? That is, we want to know the proper method to pour them so as to get solid and perfect castings.

A.—Conditions such as you describe can nearly always be traced to the use of a large percentage of turnings and light scrap or to improper melting. In either case oxidation results, the molten metal is sluggish and gives castings that are porous and full of blow-holes. Using a rather open sand, working the sand as dry as possible, skim gates and long runners, are all aids toward producing sound castings, but you will find that the most important point is to use clean, well smelted ingot metal, covered carefully at all times with charcoal and not allow it to remain too long in the furnace after it is ready to pour.

At the present time, owing to the difficulty of obtaining ingot copper, many founders have been compelled to use baled copper wire or similar light copper scrap. This material exposes a large surface during melting and gives sluggish and drossy metal and castings that show blow-holes when machined. Such metal can be used in car brasses or similar work, but where castings must be machined all over, metal made from ingot copper or specification brass made to your formula by a reliable smelter, will be found the most satisfactory and economical.—J. L. J. Problem 2,521.

REFINING

Q.—Alloys of tin and lead, or tin, lead, and antimony, when derived from scrap materials, very often contain chlorine. The ordinary refinery methods, including that of poling, fail to remove this impurity completely. Can you suggest any chemical compound, or gas, which, when applied to the molten metal, would meet the trouble?

A.—There is nothing on record to show that chlorine can be retained in these alloys. If present it would exist as chloride and the chlorides of all three metals are volatile. The trouble is due to some other impurity, and we would advise a complete analysis of the scrap and ingot to be made.—W. T. F. Problem 2,522.

TINNING

Q.—How can we add to the life and also prevent soldered black iron plate circular balls, 4½ inches diameter, which are tinned, from corrosion and wearing through, after being in water only a few weeks? Until quite recently the balls were made from copper sheet, but as we cannot now get the copper, tinplate is the substitute. Could they be dipped after tinning in some other solution?

A.—Ordinary quality tin plates are quite unsuited for making cistern valve balls. If the black plates are properly prepared and afterwards tinned, they would last indefinitely. Tinning on this work should be what is known as "charcoal" quality, viz., the tin after leaving the tinning bath is allowed to remain on the plate instead of being rolled off. They can also be galvanized if preferred on the ground of cost.—G. J. Problem 2,523.

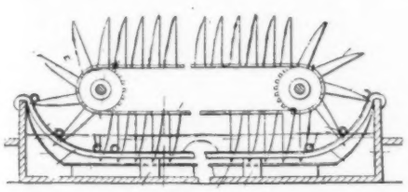
PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

1,243,098. October 16, 1917. **Electroplating Apparatus.** Louis Potthoff, Flushing, L. I.

This is an invention covering the electroplating of metallic tubular articles in an automatic manner. The principal claims on the machine shown in the cut are as follows:

In an apparatus for electroplating tubular articles, the combination with a tank for the electrolyte, of cathode rails, plugs of conducting material supporting the tubes on said rails and means for moving said tubes in succession along said rails.

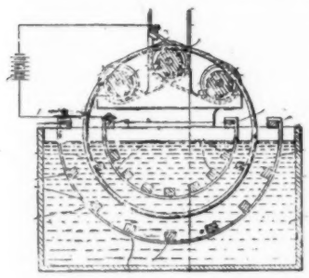


In electroplating apparatus, a current conducting device for the article being plated, comprising a plug of non-conducting material inserted in a recess in the article to seal the same, and a conductor passing through said plug and adapted to convey current to said article.

In electroplating apparatus, a current conducting device for the article being plated, comprising a plug of non-conducting material inserted in a recess in the article to seal the same, a conductor passing through said plug and adapted to convey current to said article, and means whereby said device will support said article within the electroplating solution.

1,243,274. October 16, 1917. **Method and Apparatus for Electrically Making Copper Tubes.** E. Emerson, Auburn, R. I.

This invention relates to certain new and useful improvements in method and apparatus for electrically making copper tubes, and the primary object of the invention is to provide a method and apparatus, as shown in cut, by and with which tubes can be more easily and cheaply produced; to provide for the manufacture of tubes possessed of any desired thickness of copper; and to enable the manufacture of a number of tubes in a single operation.



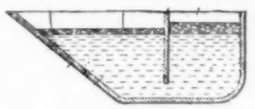
Further, the invention aims to provide a method and apparatus with which tubes may be more rapidly produced with a minimum of material and elimination of all waste in the manufacture.

The invention briefly resides in providing a fusible ring, such as lead, of the diameter which the inner circumference of the tube is to possess, and then to rotate the ring in a weak sulfuric acid solution until the desired metallic thickness has been deposited on the ring, then to split the ring and apply heat thereto so as to cause the lead or other material to melt and run out of the copper tube, leaving the latter finished and ready for use.

1,242,532. October 9, 1917. **Process of Timing Metal Plates and Other Articles.** Carl Dreymann, Baltimore, Md.

In plating sheet iron with tin the bath of molten tin is covered with a layer of palm-oil so that as the tin-coated plate leaves the tin it passes through the oil.

In the process indicated the oil used is consumed in large amount, and it has been discovered that this is due chiefly to decomposition and polymerization of the unsaturated fatty acid and glycerid. This decomposition and polymerization increase as the oil is heated, especially when heated to 250° C. or above, the temperature at which the plating with tin is effected. With a glycerid or other ester of a saturated fatty acid, polymerization and decomposition do not occur, or only to a slight extent.

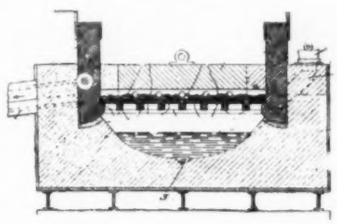


The present invention is based on the above discoveries. In the improved process the "oil" used is a glycerid or ester of a saturated fatty acid; as for example, oleo-stearin, all kinds of hydrogenated oils and fats, and artificial esters produced from palmitic acid, stearic acid or other saturated acids.

In the accompanying drawing the figure shows diagrammatically a tank or vat containing molten tin. The vessel is divided by a partition which terminates above the bottom, thereby dividing the vessel into two communicating compartments. On the molten tin in the latter compartment is a body of glycerid or other ester, and in the former a layer composed of the usual flux, such as ammonium chlorid and zinc chlorid.

1,243,416. October 16, 1917. **Process of Making Alloy Castings.** Woolsey McA. Johnson, of Hartford, Conn., assignor to the Continuous Zinc Furnace Company, of Hartford, Conn., a corporation of Connecticut.

This invention relates to processes of making castings of alloys having a volatile metal component, and more particularly castings of brass. A primary object of the invention is the provision of a process which can be economically operated upon any desired scale, whether large or small, and which is moreover capable of operation, if desired, in an intermittent manner, and without substantial or material loss of the volatile metal. According to the invention, copper and zinc may be separately melted in appropriate furnaces, as shown in cut, suitably refined, and then run in the proper relative proportions into an electric furnace of the reverberatory resistance type. In this electric furnace the molten metal is stirred, with simultaneous heating to a temperature approximating the volatilizing point of zinc, until it is converted into a homogeneous alloy which can be directly cast into any type of mold. The electric furnace may also be used for the preparation of a homogeneous melt from brass scrap or cuttings, or like alloy-products, the alloy being either melted before its introduction into the electric furnace, or melted in the electric furnace, as may be desired.



1,244,742. October 30, 1917. **Composition of Matter.** C. L. Jones, Oakland, N. J. Assignor of one-half to F. J. Molt, Riverdale, N. J.

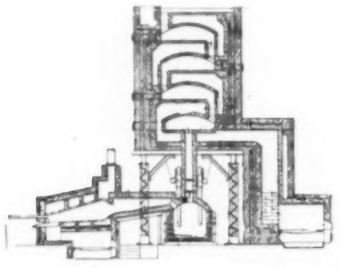
The object of this invention is the production of a composition metal which has the appearance of silver and the strength of steel, but which will not rust by exposure to the atmosphere or to anything else which ordinarily causes metals to corrode; a further object being to produce a metal which will resist most acids and which will take a high polish, can be cast or rolled into bars or sheets, or forged or otherwise fashioned into desired forms, and which is very tough and from which springs and like articles may also be formed.

The composition consists of the following ingredients combined in the manner set out.

Nickel	67.8%
Copper	28.0%
Manganese	02.5%
Iron	01.5%
Vanadium	00.2%
	100.0%

1,244,504. October 30, 1917. **Continuous Zinc Smelter.** W. McA. Johnson, Hartford, Conn.

This invention deals with an apparatus, shown in cut, for economically deriving volatile metals, such as zinc, from ore or other material containing that metal, and for doing so by a continuous smelting operation and in such a manner that the metal will be rendered directly available in a commercially desirable state.



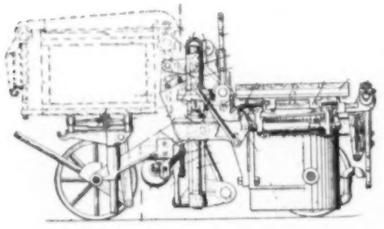
Zinkiferous ores have heretofore been smelted, by successive and quite distinct operations, in such a way as to necessitate frequent handling or manipulation of the material in subjecting it to the successive steps, and the instrumentalities aiding in the general smelting scheme have heretofore been more or less segregated. All this has contributed to the high cost of the ultimately obtained metal.

Now, this invention seeks to render available a unitary or self-contained smelting plant or structure so designed that properly conditioned ore may be continuously delivered into the receiving end of the structure, and be continuously treated therein to the end that zinc will be continually evolved and condensed directly into commercially available spelter at the delivery portion of the apparatus.

Another object is to formulate a system that will enable zinkiferous ores, containing large amounts of iron and sulfur, together with small amounts of copper and other valuable metals, to be smelted continuously and economically.

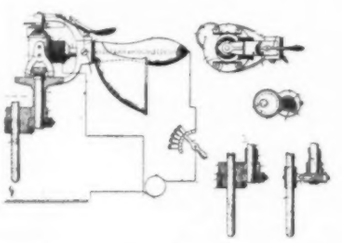
1,245,114. October 30, 1917. **Molding-Machine.** Wilfred Lewis, of Haverford, and John T. Ramsden, of Philadelphia, Pa., assignors to the Tabor Manufacturing Company, of Philadelphia, Pa., a corporation of Pennsylvania.

The principal objects of the present invention are to provide a molding machine, as shown in cut, in which the power actuating mechanism and devices are so arranged and combined that certain of the operations of the machine are automatically separated or marked so that the machine can be successfully operated even by comparatively unskilled labor; to provide a power actuated roll-over pattern-lift molding machine with the advantages of shockless jarring mechanism; to provide against accidents which might happen if the machine were rolled over without proper fastening of the flask; to provide for properly controlling the operation of drawing a pattern by power; to provide improved automatic mechanism for connecting and disconnecting the roll-over arms and pattern plate; and to provide a molding machine which possesses the advantages of a power actuated roll-over pattern-lift machine and of shockless jarring mechanism and which at the same time can be operated even by comparatively unskilled labor.



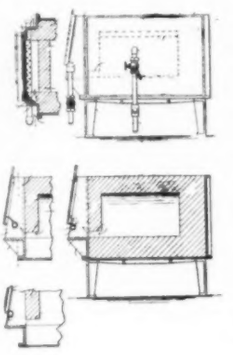
1,244,705. October 30, 1917. **Method of Electric-Arc Welding.** Charles L. Coffin, of Parks, Georgia, assignor to Electric Metal Working Co., of Detroit Mich., a corporation of Michigan.

The present invention relates to an improved method of welding and heating metals by means of the electric arc, and apparatus therefor. The primary object of the invention is to utilize the direct heat of the electric arc, while in contact with the material to be heated, by causing the material to be made one electrode of the arc and an extraneous conductor the other electrode of the arc, and to more uniformly and broadly distribute the heating action of the arc, the arc is caused to describe a path upon the material in the manner hereinafter described. For this purpose, a tool or electrode holder, as shown in cut, is provided which is so constructed and arranged that an extraneous electrode may be made to describe a path of motion over the material, thus causing the arc to travel in a path over the material and thereby distribute its heating effect.



1,245,030. October 30, 1917. **Furnace-Shield.** Walter S. Rockwell, of New York, N. Y., assignor to W. S. Rockwell Company, of New York, N. Y., a corporation of New Jersey.

This invention relates to a means of protecting the operator of a furnace from the hot flaming gases which escape from the doorway or working-opening.



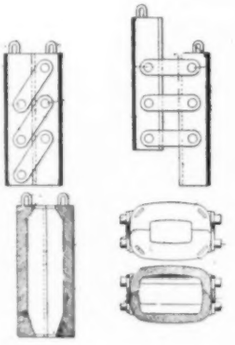
The operator is often much exposed to the heat of the gases when manipulating the bars or other stock inserted in the doorway for heating, and many furnaces are unprovided with any door for the working-opening.

In such furnaces the doorway forms an outlet for the continuous discharge of the hot gases, which thus cause inconvenience and suffering to the operator when standing before the doorway.

This invention is designed to protect the operator from such heat by means of a hood, shown in cut, forming an upright flue upon the furnace-front over the doorway through which flue the heated gases may be directed positively upward instead of blowing outward upon the operator.

1,245,046. October 30, 1917. **Ingot-Mold.** Joseph Scott, Charleston, W. Va.

This invention relates to ingot molds and it has special reference to that class of molds which are made of two parts adapted to be separated for the purpose of releasing the ingot, said parts being joined together by means of links.



The invention has for its object to simplify and improve the construction of a separable ingot mold.

A further object of the invention is to produce a simple and improved joint for the parts of the mold, said joint being so constructed and arranged that it will not be liable to become warped when the mold is in use.

With these and other ends in view which will readily appear as the nature of the invention is better understood, the same consists in the improved construction and novel arrangement and combination of parts which is shown in the cut.

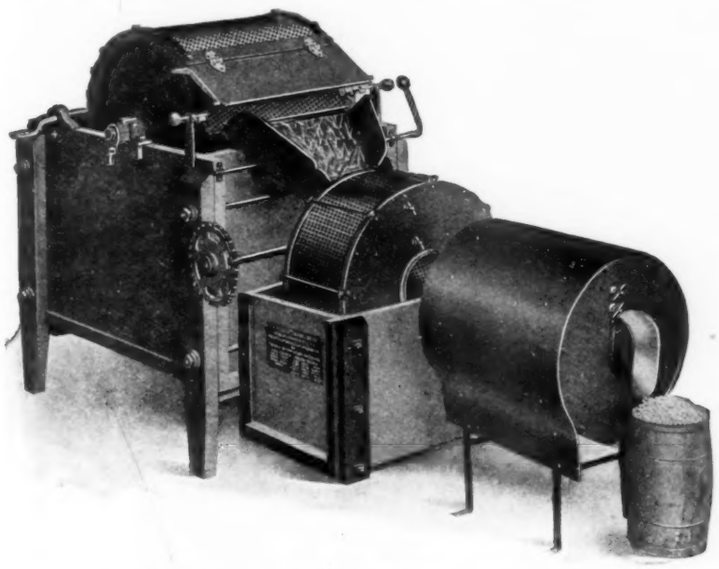
1,245,862. November 6, 1917. **Soldering Compound for Various Metals.** Wm. Brierly and N. B. Moore, Vanderbilt, Pa.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

MODEL PLATING PLANT

The U. S. Electro Galvanizing Company of Brooklyn, N. Y., have recently installed a most complete and up-to-date plating plant for the Curtiss Aeroplane Company, Buffalo, N. Y. The equipment consists of U. S. junior patent automatic self-emptying plating barrels direct connected to U. S. washing, draining and drying apparatus; U. S. patent automatic moving tanks; generators direct connected to motors on cast iron bed plates; still tanks constructed of cypress, 12 inches long by 30 inches wide by 30 inches deep, for nickel plating; iron tanks of the same size for cyanide copper plating and iron tanks of the same size for cleaning.



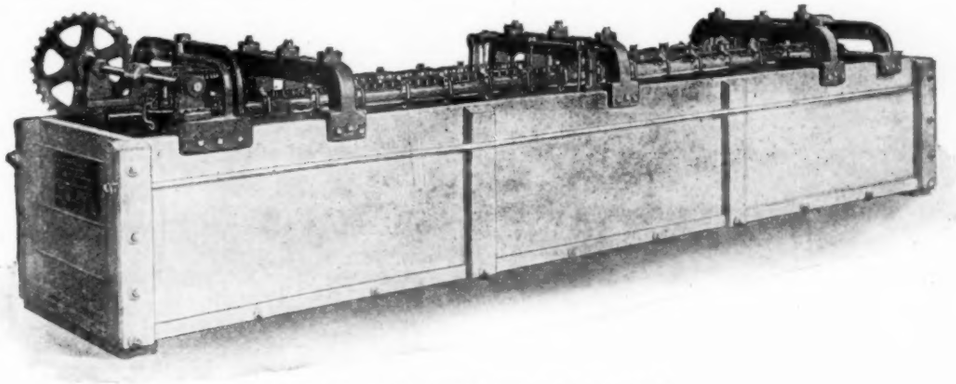
U. S. JUNIOR PATENT AUTOMATIC SELF-EMPTYING PLATING BARREL.

The Curtiss Aeroplane Company have endeavored to put their plating room on a modern and efficient basis and are using as much as possible automatic apparatus for handling their work. The U. S. junior plating barrel, direct connected with the washing and drying apparatus and also the U. S. patent automatic moving tanks, which are shown in the cuts, plate the work in a first class manner with a minimum of hand labor.

STRAIGHT GRAIN GRINDERS AND POLISHERS

The Simplex and Duplex Emery Band Grinders illustrated herewith are designed for the use of manufacturers finishing parts that require straight grain finishes. Every article finished on these grinders, it is pointed out, has a perfect straight grain finish and sharp edges, because the work to be finished is held lightly against an endless band of abrasive cloth which travels over a perfectly flat table. As there is no loosening of machine parts necessary, the abrasive band can be changed instantly without stopping the machine, by just releasing the tension between the pulleys.

SIMPLEX AND DUPLEX EMERY BAND GRINDER.



U. S. PATENT AUTOMATIC MOVING TANK.

These machines are manufactured by the T. P. Walls Tool & Supply Company, Inc., 75-77 Walker street, New York, in two different styles, and there are two sizes of each style. The Simplex takes a belt 4 inches wide by 36¼ inches long, while the Simplex-B takes a belt 8 inches wide by 61 inches long. The Duplex embodies all the features of the Simplex, with the addition of the disc grinder and an adjustable grinding table suitable for any kind of work. The disc on the Duplex is 9 inches in diameter, and on the Duplex-B 15 inches in diameter.

FIRTH'S STAINLESS STEEL

The following matter was taken from a recent address of G. Ethelbert Wolstenholme of J. Firth & Sons, Ltd., Sheffield, Eng.:

Stainless steel was discovered in 1913 as a result of experiments in the production of high tensile alloy steels. The addition of various alloys to ordinary carbon steels in certain proportions has given us materials which under various heat treatments are enormously increased in strength without impairing their ductility. This remarkable steel was made by Messrs. Thos. Firth & Sons, Ltd., and in the course of investigations in the research department under Mr. Harry Brearley, the eminent metallurgist, it was observed that test pieces cut from this particular alloy steel were unaffected by the atmosphere of the laboratory, and a series of experiments proved it to be extraordinarily impervious to all corrosive influences—in fact, a special combination of acids is necessary in order to produce any effect upon it, as, for instance, in the process of etching.

The steel was immediately requisitioned for aeroplane work under the name of "Firth's F. A. S. Steel," for which purpose, in addition to its resistance to the corrosive influences of the weather, its very great strength is most valuable. It is capable of giving a maximum stress of 90-100 tons per square inch under heat treatment, with a yield point of 70 tons. Further experiments were made towards the end of 1913 with stainless steel for table cutlery, and a number of blades were made by hand which demonstrated the claims now made. The steel, however, proved so difficult to forge by hand, owing to the extreme hardness, that knives could not be produced in this manner with any prospect of commercial success. In the autumn of 1914 further experiments were made in the manufacture of the stainless blades by power, and the steel assumed its present importance as a cutlery steel.

The term "stainless" is peculiarly appropriate as applied to cutlery, though it also denotes a distinction between a rustless and a "stainless steel." As a matter of fact stainless steel possesses both these virtues, but there is nothing new in the production of a more or less rustless steel. The latter, however, would not be proof against food stains and violent acids. Indeed, high percentage nickel steels have been manufactured for years which have successfully resisted corrosive influences, though not to anything like the same extent as stainless steel resists these influences. Moreover, nickel steel is not at all suitable for cutlery purposes.

Knives made of this steel are in all respects quite equal to those made in the best qualities of cast steel, besides having the advantage of being stainless. They are made under rather different conditions from the ordinary pocket knife, but as we here are only concerned with results, it will interest you to know that the desired end has already been achieved. It will be possible to purchase a fruit knife which is at the same time a knife carrying a good edge.

The steel is also very costly to manufacture by reason of the expensive alloy employed, and the comparatively heavy waste involved in its manufacture; but there is a very wide field of usefulness before it. The composition of stainless steel as given in a United States patent (No. 1,197,256), granted to Harry Brearly, Sheffield, England, is as follows:

Carbon	0.30%
Manganese	0.30%
Chromium	13.00%

Small amounts up to 1% or 2% of nickel, copper, cobalt, tungsten, molybdenum and vanadium are said to be without effect on the untarnishable properties.

Stainless steel is made in the United States by the Firth-Sterling Steel Company, McKeesport, Pa., under license from Thomas Firth & Sons, Ltd., Sheffield, England.

RATCHET TAP WRENCH

The Moss-Ochs Company, of Cleveland, Ohio, has recently placed on the market a new and very handy tool, a ratchet tap wrench in two sizes: No. 1 0 to ¼ inch and No. 2 ¼ to ½ inch.

It is made with a sliding T-handle, permitting its use in the most difficult corners, which makes tapping and reaming a pleasure instead of a burden. The handle may be held centre by means of a dog which automatically fits in a milled flat surface of the handle. Adjustment is made immediately to either right or left ratchet or rigid by turning a knurled sleeve.

The chuck and ratchet is carefully hardened and all other parts are substantially made, insuring unusual durability.

RATCHET TAP WRENCH

PRACTICAL AIR SPRAYER

The sprayer shown in the cut is claimed to be the simplest air sprayer made and that it has no small or unnecessary parts that are subject to wear or to getting out of order. All parts of this apparatus are made of brass, well fitted together and heavily nickel plated. The pressure required to operate this sprayer on a heavy liquid is from twenty to twenty-five pounds.

It is stated by the manufacturers, The Economy Manufacturing Company, 4755-57 London avenue, Chicago, Ill., that the sprayer illustrated, which is known as No. 5, will work on all heavy liquids, such as paints, varnishes, bronzes, enamels, japan colors, etc., and can be used to great advantage by manufacturers of machinery, automobiles, gas and electric fixtures, sheet metal specialties and by a great many other industries.

Additional information may be had upon request.

ECONOMY AIR SPRAYER

WELDING ALUMINUM

A new modified welding process for the repair of aluminum has been discovered: 350° F. is all the heat that is required by this method. All kinds of aluminum repair work can easily be accomplished by the ordinary mechanic by following a few simple directions, is the claim made by the manufacturers.

These instructions involve the use of an aluminum solder which has been given the name of Alumunite. This solder contains no antimony or lead, but is made up of aluminum, tin and zinc in varying proportions. The tensile strength on butt or lap joints is from 8,500 to 12,500 pounds per square inch. Repair jobs are claimed to remain permanent and not to disintegrate with time and exposure.

Full particulars can be had by applying to the Alumunite Manufacturing Company, Inc., 427 Fourth avenue, New York City.

WHITE & BRO., INC., NEW OFFICE

White and Bro., Inc., Philadelphia, Pa., smelters and refiners, announce that having outgrown the office facilities at the works they will soon move into general offices at 403-412 North American Building. This company has been in the metal business since 1869 and make the celebrated W.B. brand of casting copper. The company have an office in the Trinity Building, New York, in charge of C. G. Dickinson.

ASSOCIATIONS AND SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

AMERICAN ELECTRO-PLATERS' SOCIETY

Philadelphia Branch.—Meets first Friday of each month in the Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce streets. Secretary, Philip Uhl, 2432 North 29th street, Philadelphia, Pa.

The Philadelphia Branch held its fifth annual banquet on Saturday, November 17th, at Kugers' Restaurant, with an attendance of fifty-four members and friends, ten of whom were members from New York and Newark branches. After opening with singing "America," President Otto W. Mott of the Philadelphia Branch made a brief address of welcome to the platers and read letters which had been received from members who were unable to attend, including Walter Fraine, Charles H. Proctor, William Salmon, George B. Hogaboom, Oscar E. Servis, H. J. Richards, Prof. Smith and William J. Bell.

Mr. Mott then introduced Dr. Blum of the Bureau of Standards, who gave a brief talk on experiments being made by the government and also mentioned that all platers should co-operate in perfecting finishes suitable for war equipment. Dr. Lukens of the University of Pennsylvania, the next speaker, gave some suggestions on co-operation with the Bureau of Standards. Then followed short talks by William Voss, Thomas Haddow, H. Flanagan, W. C. Gold, Horace H. Smith, Dr. Buckwalter and C. G. Backus.

Taking all into consideration the evening proved a very pleasant one and special credit should be given to the committees who had charge of arrangements, as they did exceptionally fine work. These committees were composed of: Banquet committee, Otto W. Mott, William P. Scott and Philip Uhl; arrangement committee, E. Homan, S. Barr, H. Seaser, Charles Bayer, H. Snyder, M. Smith, D. A. Metz and F. O. Neal; reception committee, J. L. Dinan, H. Farrand, W. C. Gold, A. Keiser, G. Coller, L. Kathman.

Bridgeport Branch.—Meets third Friday of each month in its laboratory, 260 John street, Bridgeport, Conn. Nelson A. Barnard, president and Royal F. Clark, P. O. Box 671, Bridgeport, Conn., secretary.

Fifteen members were present at the October meeting of this branch and N. E. Dabolt, of New Haven, Conn., gave a very interesting talk on the various methods of rust-proofing iron and steel, and also exhibited samples which had been finished for three years. C. Wyrtzen, of Bristol, Conn., spoke on the value of the A. E. S. "Monthly Review' to the isolated members of the society. At the suggestion of Royal F. Clark it was decided to select a topic for discussion at each meeting and "Cleaners" was the subject chosen for the November meeting.

The November meeting was held November 19 and all present entered into the discussion of "Cleaners." Messrs. Mason and Paine, of Swan & Finch Company, were present, and Mr. Mason gave a very interesting talk on the manufacture of whale oil soap. George B. Hogaboom spoke on the cleaning of brass shell cases. The application of Louis J. Maraffi for active membership was accepted.

PERSONALS

ITEMS OF INDIVIDUAL INTEREST

Horace G. Gravelle has accepted a position with the Rubber Insulated Metals Corporation, of Plainfield, N. J.

H. Earl Cole has become connected as general manager and consulting metallurgist with the Monadium Company of Chicago, Ill.

R. J. Spigott has taken a position as superintendent of the raw material department at the Bridgeport Brass Company, Bridgeport, Conn. He has been for some time with the Remington U. M. C. Company of that city.

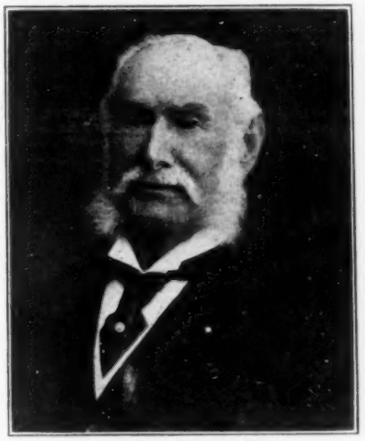
W. C. Webster, who for several years has been secretary and general manager, also director, of the Nichols Copper Company, 25 Broad street, New York, has severed his connection with that company. Mr. Webster expects to take a rest before assuming further duties.

DEATHS

R. B. Dangeleisen, age 31, sales manager of The Globe Machine & Stamping Company, Cleveland, Ohio, died at Saranac Lake, N. Y., on November 12th. He entered the employ of the Globe Company in 1902 and, because of his efficiency and executive ability, was advanced rapidly, but deservingly, to the position which he held at the time of his death.

MARKS LISSBERGER

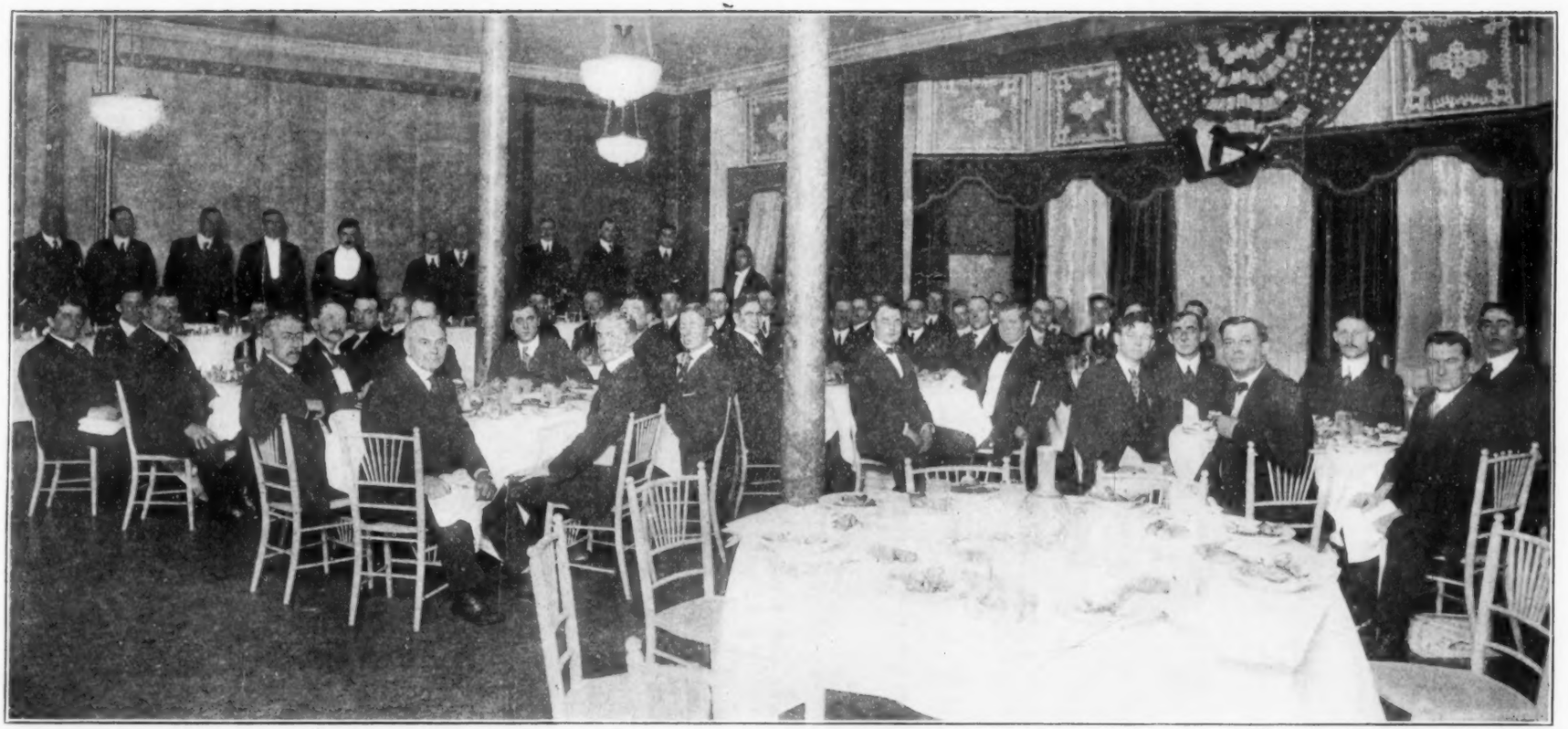
Marks Lissberger, president of Marks Lissberger & Son, Inc., Long Island City, New York, manufacturers of solder and white metal products, died November 9th. Mr. Lissberger was 77 years of age at the time of his death.



MARKS LISSBERGER.

Mr. Lissberger started business in Baltimore, Md., in 1860 and in 1872 started the Garden City Lead Works, in Chicago, Ill. He came to New York in 1876 and in 1885 formed, with his son, Milton Lissberger, the New York Smelting and Refining Works, which in 1890 was changed to Marks Lissberger & Son. Mr. Lissberger was during all his long life closely connected with the metal trade and was actively engaged in business up to a few months before his death. He was held in high esteem by his business associates and those with whom his active life brought him in contact. He is survived by a son, Milton L. Lissberger, vice-president of the Marks Lissberger Company, and a daughter.

FIFTH ANNUAL BANQUET OF PHILADELPHIA BRANCH AMERICAN ELECTRO-PLATERS' SOCIETY, HELD AT KUGER'S RESTAURANT, PHILADELPHIA, PA., NOVEMBER, 17, 1917.



FIRST ANNUAL BANQUET OF PROVIDENCE BRANCH OF AMERICAN ELECTRO-PLATERS' SOCIETY HELD AT CROWN HOTEL, PROVIDENCE, R. I., DECEMBER 1, 1917.

Providence Branch—Meets second and fourth Wednesday of each month at 26 Custom House Street, Room 16. John McDonough, president and Albert J. Lemrise, 124 Waverly Street, Providence, R. I.

The Providence Branch held its first banquet at the Crown Hotel Saturday evening, December 1, 1917. The attendance was considered large inasmuch as this is the first attempt of the Providence Branch to hold a banquet. President John McDonough delivered a short address of welcome to the guests and introduced Dr. Albert W. Claflin as toastmaster for the evening. Dr. Claflin spoke in a witty manner of the work accomplished by the Providence Branch. George B. Hogaboom, supreme vice-president, was then introduced and his address was directed mainly at the manufacturers who were represented by Mr. Walcott, president of the Jewelers and Silversmith's Association of Providence. Mr. Hogaboom also thoroughly explained the object of the American Electro-Platers' Society.

Mr. Hogaboom was then followed by Mr. Walcott, who stated that the manufacturers were well disposed towards the society, that they were contributing much to the Rhode Island School of Design in that respect and that he felt sure that no manufacturer could be so shortsighted as to oppose a cause of that kind.

Several other speakers were heard, including Messrs. Dalbolt of Bridgeport, Conn., and Schneider and Herrick of New York. Mr. Herrick was recently transferred from the New York Branch to the Providence Branch, and stated that he would devote all his spare moments to help along the young branch and promised a lecture on acid copper baths for the next meeting to be held December 12.

The speakers emphasized that the society did not propose, as did some labor unions, to take advantage of conditions to demand better pay and working hours, and merely seeks the betterment of conditions for its own members. The object was, it was pointed out, to give the platers opportunity to study and investigate and benefit both themselves and the manufacturers.

A letter from Charles H. Proctor and a telegram from H. J. Richards, editor of the Monthly Bulletin, expressing their regrets at not being able to be present and good wishes to the Providence Branch were read.

Oxidized brass calendars were distributed as souvenirs by the Celluloid Zapon Company of New York.

TRADE NEWS

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

NEW BRITAIN, CONN.

DECEMBER 3, 1917.

With never the sign of a let-up, business conditions among the metal manufacturing concerns in New Britain continue to keep pace with the war-time activities of other bustling manufacturing communities throughout the country. Although only a comparatively few direct war orders are being filled by local concerns, there are a number of sub-contracts and government departmental contracts being handled by local interests. At the Traut & Hine Manufacturing Company, where business was never better, large consignments of buttons for military clothing, as well as buckles, snaps, safety razors, etc., are being turned out. Across the street its sister concern, the North & Judd Manufacturing Company, continues a veritable hive of industry, its large complement of employees being busily engaged in turning out government orders of buckles, trappings and other army accoutrements.

At the New Britain Machine Company, where a new, large addition has just been completed ready for use, the big lathes are turning out parts of anti-aircraft guns, which are being turned over for government use as rapidly as possible. At the present time there is a small army of commissioned officers in the ordnance department in the city spending their time at these various concerns inspecting the articles made preparatory to government acceptance. Landers, Frary & Clark, the largest cutlery concern in the world, likewise is doing its bit for Uncle Sam and is working on an enormous order for bayonets, to be used on the rifles of the American Expeditionary forces and also on the rifles to be used by the National Army.

Several departments of the American Hardware Corporation, particularly the P. & F. Corbin division, are also doing departmental work for the government. The last named division is turning out quantities of locks and other builders' hardware for use on the new government buildings, and also for use on ships.

The Union Manufacturing Company, makers of chucks and machine tools, is also busy, as is the Hart & Hutchinson Manufacturing Company, makers of steel lockers, the Fafnir Bearing Company, manufacturing ball bearings, and the Hart & Cooley Company. Once again incipient labor troubles seemed to have been smoothed over.

Continuing its policy of expansion with a view to the development of future business, The Stanley Works now stands as one of the largest monuments to industry that New England has. The completion of the new "puddling plant," now under construction, will make this concern the most up-to-date of its kind. An idea of the growth of the Stanley Works may be gleaned from the fact that during the past 18 months new buildings valued at $335,000 have been erected. While there were a total of eleven new buildings erected, several of them were of small construction, but there were four of more than ordinary size. These cost, respectively, $24,000, $48,000, $125,000 and $130,000. It is also expected that the Landers, Frary & Clark factory will again build some new factory buildings before long.—H. R. J.

HARTFORD, CONN.

DECEMBER 3, 1917.

Owing to the great congestion of freight in this city, the Manufacturers' Association of Hartford County, working with the transportation committees of the Connecticut State Council of Defense and the Hartford Chamber of Commerce, is endeavoring to keep the Hartford steamer line open during the coming winter. The matter has been talked over by the committees and immediate action has been advised. The New York, New Haven & Hartford railroad has been asked to operate the Hartford boats between New York and Saybrook after the Connecticut River is closed for the winter. The transportation committee proposes that a train be operated over the Valley Branch, meeting the boat at Saybrook and running to Hartford, discharging the freight at the freight house used by the transportation company. The freight congestion has been very bad for some time and the manufacturers have had a hard time in getting raw material to keep the factories going, many of which are working on large government contracts for the carrying on of the war. The new proposition is expected to help matters greatly.

With the increasing government war orders, the government is taking every precaution regarding the hiring of German aliens working in factories doing war work. Recently over twenty employees of the Pratt & Whitney Company were discharged because they were alien enemies. The plant was ordered to dismiss the men by the government. There are no aliens now at the work in the factories. Other factories are gradually weeding out men whose actions have been in the least suspicious.

All of the Hartford factories are rushed with work, a number of them having large war contracts, both for this country and our allies. The manufacturers are complaining about the scarcity of help, despite the fact that exorbitant prices are being paid to the workers.

The Colt Patent Fire Arms Manufacturing Company, of this city, has acquired the Meriden, Conn., plant of the Westinghouse Company, and will manufacture there the Browning light machine rifle. The Colt company will take over the whole organization. Under the appropriation of over $300,000,000 by Congress for machine rifles, the industry will be indefinitely expanded and the Colt company, the largest manufacturer of rapid fire guns in the country, will expand in proportion.

Howard C. Woglom, superintendent of the Pratt & Whitney Company for ten years, has resigned to take an important place at the Colt Patent Fire Arms Manufacturing Company factory. Mr. Woglom will be succeeded by William W. Corey, who has been assistant superintendent. Mr. Woglom has been connected with the Pratt & Whitney Company for seventeen years, beginning as draughtsman.—P. B. D. S.

PROVIDENCE, R. I.

DECEMBER 3, 1917.

Metal workers of all kinds and lines are at present experiencing a rather disconcerting chaotic situation that has no immediate indication of settlement or improvement. While there is more work than the various plants can take care of the labor problem that has been the principal handicap to the concerns for many months is now overshadowed by the forebodings of fuel shortage and the commandeering of plants by the Government. Although nothing definite is known in this connection, pretty plain hints have been given that there would be a very decided curtailment of fuel excepting in such cases where Government contracts were being filled or factories were employed in the production of work necessary to plants working for the Government.

This is especially the case with the manufacturing jewelers, as it has been stated almost for a certainty that the Government intended to shut off the supply of fuel to all non-essential industries and jewelry comes almost at the head of the list on these commodities. Difficulties in obtaining supplies of copper, lead, etc., has interfered materially with the operations of a number of the metal working plants, although nearly all have been able to keep moving. The future does not, at this time, appear to be as promising as could be desired.

Already a number of concerns have accepted contracts from the Government for metal work of various characters. Some are working upon buttons for garments, others on buckles, metal insignia, clasps, gun fittings, munitions and other articles that are calling for the full equipment and capacity of the plants. An instance of the almost abnormal increase in these directions may be cited in the case of the Gorham Manufacturing Company. With its equipment of hydraulic presses, stampers, cutters, etc., at its plant at Elmwood, it was recognized early in the outbreak

of the European War, that it was especially prepared for such work. The corporation, however, erected a number of buildings that have since been specially operated on munition work—first for the Entente Powers and later for the United States Government. So extensive have the demands become for this work that the company has commenced the establishment of an independent munition plant in an isolated section of the town of East Providence, where it is preparing not only to manufacture munitions, but to load and store shells, etc., ready for shipment.

The new plant of the Gorham Company is located in the village of Phillipsdale, on the banks of the Seekonk river, where there is ample opportunity for wharves and dockage, as well as ample railroad facilities. The contract has been awarded for the new buildings, which will be one-story high, of frame, and consist of two receiving buildings, each 36 by 48 feet; one receiving storeroom, 56 by 70 feet; two assembling buildings, each 50 by 150 feet; leading building, 64 by 180 feet; two women's buildings, each 50 by 150 feet; a loading building, 64 by 180 feet; two women's toilet buildings—one 36 by 50 feet and the other 25 by 40 feet; two men's toilet buildings, each 30 by 30 feet; a guard building, 16 by 20 feet, and an office building, 39 by 40 feet. This will make a total ground space of 66,756 square feet in the 15 buildings already contracted for. The layout of the plant calls for several other buildings that will be erected later.

J. F. Sturdy & Sons Company, Attleboro, report that their new factory at Buzzard's Bay, Mass., which was started last summer, is very busy making ladies' watch bracelets. They employ 25 women operatives, and expect to increase that number in the near future. C. H. Cummings, who is identified with the business at Attleboro Falls, is manager of the new factory.

Another plant in this city where extensive additions are being made is the Nicholson File Company, on Acorn street, where permission has been granted by Inspector of Buildings for the erection of four additions to buildings already built, which will increase the size of the plant by about 34,000 square feet of floor space. The main additions will be 42 by 142 feet and 67 by 147 feet, two stories in height. The other two additions will be 29 by 11 feet and 39 by 40 feet, part one story and part of two stories. These additions will all be of brick.

John E. Piling and Henry C. Hart, of this city, and Edward M. Brennan, of South Kingstown, filed articles of incorporation with Secretary of State Parker recently for the incorporation under the laws of Rhode Island of the Piling Chain Company, a concern to be located at 8 Temple street, this city. The company will have a capital stock of $10,000 divided into 100 shares of a par value of $100 and will engage in a general business in dealing in chain and machinery.

According to their respective statements filed at the office of the city clerk Henry Saliagian and Hagop Piligian are the owners of the American Electro-plating Company, 25 Calender street; Hyman Lightman and Hyman Churcnin, of the Franklin Jewelry Company, 197 Eddy street; Joseph J. Beck and Harry Goldberg, of the National Auto Metal Works, 320 Pine street, and Armenag Nalbandian and Boghis Saliagian, of the Modern Enameling & Soldering Company, 220 Eddy street.

The Fairmount Foundry Company has commenced the erection of a one-story addition to its foundry building on Second avenue, Woonsocket. It will be 75 by 80 feet and will cost $6,000.

The Albany Manufacturing Company has been organized to manufacture "Nu-Gold," a process which, it is claimed, will revolutionize the manufacturing jewelry industry. Officers of the new concern are as follows: President, William M. Miller; vice-president, T. F. Whittelsey; secretary, Frank Halloran; treasurer, W. Y. Kinleyside. The firm has located in the Bliss building, North Attleboro, with Frank A. Gendron, of Boston, as general manager.—W. H. M.

BOSTON, MASS.

DECEMBER 3, 1917.

Notwithstanding numerous hindrances, business continues satisfactorily on the whole, and while there is but little inclination to expand, it is not because the demand is lacking, but rather because of the unwillingness on the part of individuals. Industries which in any way contribute toward the war are, of course, highly active, and in the vanguard stands the metal industry. Business is now centering its efforts on those things which are most useful and all unnecessary work is being curtailed. The fuel situation is far from satisfactory and in many instances is proving an obstacle to production. Government demands are unprecedented and it is unfortunate that any hindrances should develop to thwart the output. Also labor and transportation conditions are none too satisfactory in several branches and it is difficult to bring relief. Prices are higher in every respect, but this has not caused a reduction in retail distribution, which continues in large volume.

An invention of considerable merit recently put on the market is a metal known as Nu-Gold, invented by a Boston jeweler. It is similar to 14 karat gold and can be handled exactly the same as gold in manufacture. It can be rolled, stamped, soldered and drawn into wire, or beaten into leaves and cannot be detected, except by the acid test. R. T. E.

ROCHESTER, N. Y.

DECEMBER 3, 1917.

Every manufacturing industry in this city is running at top speed at the present time, the output being tremendous and the demand heavy. Business conditions, therefore, are good, and no complaint is heard except from circumstances that affect every city and town of any importance the country over. Prospects are brighter, too, for prompter deliveries of materials are certain and many concerns are now catching up with orders that fell away behind because of inability to ship either in or out of the city.

The local market for copper and brass of all grades has been quiet of late, although the delivery of materials has been much better during the past month. Freight conditions, however, are very bad at this time of the year, which fact is bound to have its effect on the receipt of all metals. Sheet copper plates are lower and are quoted here at 33 cents base. Sheet brass is quoted at 28 cents and brass rods 25½ cents base. Red brass is 1½ cent higher than the yellow sort.

There is no market in Rochester for aluminum, the government having requisitioned practically all of the available aluminum in sight. It is not quotable here and is difficult to get in even small quantities. Deliveries have been all the way from two to three months behind, and manufacturers have been forced to draw on reserve stocks, which it was well they provided for.

Rochester manufacturers are to be given credit for long range perception, and today finds the warehouses in this city well supplied with all kinds of metals wanted by local industries. Under the circumstances there is no necessity for holding up contracts entered into, as every emergency apparently has been guarded against.

Lead is higher, being quoted at 6¼ cents. Demand is good and deliveries fairly acceptable. Spelter is lower and is quoted here at 7.92½ cents. In fact the price is at the same normal point as prevailed before the beginning of the European war. Tin is quoted here at 78.50 cents. Tin plates are worth 7.90 cents, and galvanized 6.45 cents.

Applications for permission to erect three large buildings to be devoted for war industries were filed with the Building Bureau at the City Hall today. Two of the structures will be in the nature of supplements to the present plant of the Symington-Anderson Company in University avenue, while the third is to be put up by the Bridgeford Machine Tool Company.

One application of the Symington concern calls for the erection of a one-story steel building at a cost of $125,000. It will be used as a rough machine shop. The Symington Forge Company will erect a one-story steel building at a cost of $150,000. The Bridegport company's plant is to be 50 feet high and 140 x 204 feet in length. The building was originally located in Pennsylvania, where it was used in filling a war contract. It has been taken up and will be re-erected here as a permanent plant, near Winton road, at an estimated cost of $60,000. Every metal that goes into the making of war materials will be required in the three plants.—G. B. E.

CLEVELAND, OHIO

DECEMBER 3, 1917.

Members of the metal industry of Cleveland and vicinity are taking active part in the war program insofar as big business can help. E. E. Allyne, president of the Aluminum Castings Company, heads the list of bug business men of the district who are

giving at least part of their time to the government. Mr. Allyne is on the Committee on Aluminum of the Council of National Defense.

In connection with the revised standard of working conditions, due to the entry of women into many of the shops here where formerly only men were employed, a committee of local manufacturers and representatives of the Ohio Federation of Labor met this week to discuss proposed new methods of safety in factories and shops. Safeguarding of machinery, buildings and all dangerous hazards are up for consideration. Sanitation, ventilation and lighting are among other factors looking to the benefiting of employees.

Offices of the Engel Aircraft Company, who has offered its product to the government, have been moved to Niles from Cleveland. As stated before in this column, Cleveland capital backs this project. George S. Patterson, one of the promoters, expects manufacturing to begin some time in December. H. D. Baker, brother of Secretary of War Baker, and one of the organizers of the company, is spending much of his time at Niles looking after the perfecting of plans for the production of airplanes for the government.

Plans for expending its production, to take in the production of cranes to be used in connection with torpedo boat destroyer construction, have been completed by the Cleveland Crane and Engineering Company at Wickliffe. Officials of this plant have announced the receipt of contracts for two thirds of the cranes to be used in a $100,000,000 eastern plant which is to build the destroyers.

War orders are indirectly the reason for expansion of the plant of the Warner and Swasey Company on Carnegie avenue. A new two-story addition, on a plot 70 by 100 feet, at a cost of $45,000 will be built.

The Standard Brass Foundry Company has purchased additional land adjoining its old plant, and near the new unit erected last spring. Plans are for a further increase in production facilities.

The sheet metal firm of G. F. Mitchell and Son is planning for a new factory to be erected on a site recently purchased at London and Watside Roads and Nickel Plate tracks, in the East End. The tract is 12 acres in extent.

Two new units to the plant of the Parish and Bingham Company, hardware manufacturer, soon will rise on the company's tract at Madison avenue and West 106th street.

The Cleveland Aluminum Castings Company has taken title to property in the vicinity of Ansel road and St. Clair avenue.

Plans for manufacturing a new motor truck are being made by directors of the Hall Motor Company and the Abbott Corporation, and who approved the merger of these two firms. The consolidation gives the new firm the Abbott plant here at East 152d street. The passenger cars made by the Hall and Abbott will be continued.

Employees of the Ferry Cap and Set Screw Company are attending classes in citizenship and English three times a week now. They are being paid while learning. This is part of the general scheme of manufacturers to co-operate with the Chamber of Commerce Industrial Department in increasing the standing of foreign born here. Plans for instruction women are being made by Miss Mary V. Janicki, in charge of factory schools.

What the chances are for American manufacturers, both during the war and after, to do business with Australia is being told by Philip B. Kennedy, former American commercial attache at Melbourne, and now commercial attache at London. Mr. Kennedy was invited here by the Chamber of Commerce to tell Cleveland business men about the Australian market for Cleveland products. Mr. Kennedy will make a tour of the United States in the interest of manufacturers of the country.—C. C. C.

COLUMBUS, OHIO

DECEMBER 3, 1917.

The metal market in central Ohio territory is holding up steadily in most every line. Demand for tin, copper brass and aluminum is good in every way and business is going along about as usual. Metal using concerns are mostly buying from hand to mouth as it were as they are loath to accumulate stocks under existing conditions

The strongest feature of the market is the demand for tin, which is now quoted at 80 cents. Brass is unchanged from the previous month, although the demand has increased slightly. Copper is selling at the government price of 23½ cents. Zinc is down to a certain extent and is selling in the neighborhood of 7.75 to 8. Typemetals are in good demand and quotations continue high. Spelter is also selling well.

Metal users and dealers are uncertain as to the future of the metal market. War conditions are so unusual that they can not predict in the future to any degree of satisfaction. But supplies for the present are adequate in this section and every effort is being made to keep a supply on hand. Railroad congestion and lack of motive power are delaying shipments.

The Dayton Aluminum and Manufacturing Company, of Dayton, O., has been incorporated with a capital of $10,000 to make aluminum articles. The incorporators are: Leo A. Stotter, Fred Eldridge, Fred Hazel, Carl Wilcke and I. L. Jacobson.

The Metalcraft Company, of Cleveland, O., has been incorporated with a capital of $200,000, to make metal articles. The incorporators are Mark A. Copeland, F. B. Evarts, R. F. Nailler, O. E. Schultze and C. Verby.

The Buckeye Aluminum Company, of Wooster, O., has increased its capital from $250,000 to $500,000.—J. W. L.

CINCINNATI, OHIO

DECEMBER 3, 1917.

With undiminished pressure on the manufacturers of machine tools for capacity production, to meet the needs of the Government in the matter of munitions, motors and so forth, the principal factor in local activity in the metal trades continues strong.

In fact, as long as the war lasts, to say nothing of the period after the war, it seems certain that the machine tool people will not only have plenty of business, but will be taxed to meet the demands made upon them. This means, of course, that the foundries which supply them with castings, bronze and brass parts, and so forth, will be correspondingly busy. The production of gasoline motors on an enormous scale, for use in aeroplanes and heavy trucks, is becoming an increasing factor in the demand both for machinery for metal working and for parts. Motor parts are made by several local plants, and machinery for the production of parts is turned out also. All of these products involve some use of the metals aside from iron and steel and furnish their share of the remarkable stimulus which the war has brought to the demand for copper, zinc and nickel. Ordinary commercial business is fair, though not extraordinary. As the country is rapidly getting down to a real war basis, it is only to be expected that the commercial yorld will follow the lead of the Government, not to say its actual command, and eliminate as far as possible the non-essentials. One important example of this, seen in Cincinnati as well as in other cities, is the discouragement to large construction activities on account of the railway embargo laid by the Government against the movement of heavy steel for other than purposes essential to the prosecution of the war. This has had the natural effect not only of putting a stop to several large jobs which have to use heavy steel, but of tending to reduce all building work; and a corresponding reduction in the demand for building hardware, plumbing supplies and the like has been experienced. Members of the trades affected by this are taking it in good part, however, as a necessary incident to the war, and are doing their best under the circumstances.

Contributions to the "Thimble Fund," a money-raising plan borrowed from England, under which unused or discarded articles of gold, silver and copper are converted into money, have been liberal in Cincinnati, and will result in substantial additions to the fund. A leading jewelry establishment has exhibited a number of silver ingots secured from the reduction of the articles contributed. The American Zinc Products Company has been incorporated at Warren, O., with a capital stock of $1,000,000, by D. W. Kerr and others.—K. C. C.

DETROIT, MICH.

DECEMBER 3, 1917.

The metal trades show no decline in business in this section. The government demand for supplies, munitions and automobile equipment is placing heavy burdens on practically all the large automobile and metal trade plants.

It was announced this week that war orders had been distributed among certain automobile plants here, estimated at approximately

$500,000,000. This vast sum covers contracts, it is said, for automobiles, motors for aeroplanes and other supplies. Work has recently been started on a $1,000,000 plant by the Dodge Brothers, automobile manufacturers, in the extreme eastern part of the city. It is not known exactly what this plant will produce, but it is reported that motors will be made to a large extent.

The Cadillac Motor Car company also reports taking orders for government work worth many millions. At the same time Henry Ford has placed at the disposal of the government the great Ford plant in Highland Park here, where 41,000 are now employed. This plant is reported manufacturing equipment for aeroplanes and ambulances. It should be noted that all these plants are using vast quantities of brass, copper and aluminum and gray iron.

It also is reported that a number of the great automobile plants engaged in government work will curtail to some extent the manufacture of pleasure cars, in order to give preference to the war orders so pressing them.

The war, instead of causing depression here, is crowding the great manufacturing plants to their capacity. Thousands of men are given employment and it is apparent thousands more will be needed to meet the demands.

The only threatening aspect at present is the scarcity of coal and transportation facilities. The weather has been favorable thus far and manufacturers have been able to operate with no serious trouble. However, there is always that possibility of a tie up due to lack of coal. One gratifying feature is the fact that Detroit is suffering no labor troubles and it is believed none will be experienced, as employers are paying the highest wage in the country.

The general outlook among the manufacturing jewelers is not so promising, although a great quantity of holiday jewelry has been produced within the last few months. It is apparent the holiday trade will be considerably curtailed due to the heavy demand on the people for war loans, and benevolences, in the interest of the soldiers.

The manufacture of plumbing supplies is reported not of the best, but practically all these concerns are engaged in producing war supplies and are not affected in a financial way to any great extent.—F. J. H.

LOUISVILLE, KY.

DECEMBER 3, 1917.

The year 1917 will be posted up with the copperworking trade of Louisville as the most erratic year that has been experienced in this section of the country. After a bad beginning in the early spring mid-summer business was active on distillery work, and other business came along at a good pace. Then the Government legislated against distilling, and the big end of the copper business in the Louisville district was automatically dropped from the list. Whether or not distilling will ever get on its feet again is a question. Some members of the trade are of the opinion that the war time measure spells national prohibition, and that the distilleries will never get back again. In any event there will practically be no further distillery work until the close of the war. With the exception of the dropping of the distillery work things have been good in Louisville this year, there having been a lot of special work of one kind or another, Government work and general casting for parts of milk machinery, railroad equipment and casting for auto plants and general manufacturing.

Hines & Ritchey report that they are at present busy on getting several distilleries into shape to resume manufacture of grain alcohol about the first of the year, and that indications point to several of the larger plants being converted into alcohol stills, as the Government demand for alcohol is increasing, as alcohol is one of the products depended upon to aid in winning the war, it being largely used in manufacturing explosives, for heating and other work. The company has also done a good deal with milk machinery during the year, special distilling equipment for dry cleaners and bottling machinery.

Labor is very scarce at the present time, and core makers are hardly to be had at any price, while moulders of all kinds are scarce, men having gone into the army or better paying lines. At that the cost of such labor has been advanced about thirty per cent. during the year, as general laborers are being offered thirty cents an hour by big contractors, and prices have to be raised to hold men.

Metal prices are fairly steady at the present time with the local demand a bit light. Sheet copper, base price, is quoted at 34 cents; tubes, 42 cents; bronze, 18 cents.; brass, 16@17 cents for medium heavy and 18 cents for heavy. While the Government price on copper ingots is 23½ cents, the copper trade is not getting material at that price, and it would probably cost 27@28 cents a pound in Louisville. Heavy scrap copper is selling at around 23½ and 25 cents at the present time, and scrap is being largely used locally.

The Independent Brass Works has been handling some direct Government orders on copper kettles, 20 to 30-gallon size, for use in cooking at Camp Taylor, Louisville, and other points; these kettles being manufactured for the Quartermaster's Department and distributed wherever needed. The concern has also been handling some indirect and sub-let Government work on brass packing rings and equipment to be used in shipping, which is steadily picking up now that Congress has finally decided just what it is going to do.

George Heckel, representing the New Jersey Zinc Company, was in Louisville last week for the purpose of delivering an address, illustrated with pictures of the operations at the big New Jersey Zinc Company's plant. Mr. Heckel stated that due to the enormous demand for X. X. zincs used by the rubber and tire manufacturers it has been found necessary to withdraw X. X. zincs from the paint manufacturing trade, and in the future the paint trade will get leaded zincs only, while all X. X. zincs will be given to the rubber people, who need them in order to do their part in winning the war. This arrangement has been approved by the Government, which has arranged to accept paints in which leaded zincs are substituted for 99 per cent. X. X. zincs. The moving pictures, showing distillation and condensation methods used in obtaining pure zinc, proved of great interest to the members of the Louisville Paint Superintendents' Club.

Manufacture and shipping of enameled and other plumbing ware out of the Louisville district has been light during the past few months, the falling off in building operations throughout the country having greatly reduced the demand for plumbing goods. One of the large local manufacturers, who formerly shipped an average of thirty solid cars of plumbing goods a week, has been shipping less than half this amount during the past few weeks. Mixed car shipments have picked up somewhat in the meantime, however.

Wiley Bryan, of the Belknap Hardware & Manufacturing Company, large jobbers of plumbing supplies, brass goods, mill supplies, etc., has been appointed fuel administrator of the State of Kentucky, and is co-operating with the national organization in straightening out the coal troubles of the country. Kentucky is one of the most important sections, as there are two big coal fields in the state, one in eastern and one in western Kentucky.—O. V. N. S.

TRENTON, N. J.

DECEMBER 3, 1917.

Trenton manufacturers are somewhat alarmed over the notices recently received from the United States government to the effect that their stock of copper and brass may be taken over for federal purposes. As a result of this notices have been sent to all the principal customers announcing the fact and also announcing that orders cannot be delivered on time. This places the manufacturers in a peculiar position. Many of them purchased large supplies of copper and brass, anticipating that the prices would be advanced, and may now have to allow the government to have the material if it is needed. Therefore customers are very anxious to have their orders filled before any federal action is taken. The largest manufacturer of copper in this city is the John A. Roebling's Sons Company, who handle orders from the small copper wire to the big feed wires and cables.

Manufacturing plants in this city are again hard hit by the scarcity of coal and new regulations are being urged to save the fuel. The fuel proposition has affected several metal industry plants, but the works are managing to keep running. In order to reduce the current pressure between the hours of 4 and 6 o'clock in the afternoon, officials of the Public Service Corporation have taken up the question with several manufacturers of changing the hour of operating their plants. The corporation has made arrangements to increase its generation capacity, but

the inability of the firms to ship necessary material has caused considerable delay. The action by the Public Service officials is a precautionary one to prevent any possible shortage in the generation of electricity. The corporation wants manufacturers to close down their plants at 5 o'clock and allow their employees an hour for lunch. It is claimed that by this plan the current could be more evenly distributed.

The New Jersey Zinc Company will employ women in the chemistry department to take the places of enlisted men or those who have been drafted. The company will fit up one of the new stucco houses.

Business continues good in the metal plants here. The Trenton Brass and Machine company has placed a number of new lathe hands and polishers and buffers at work. The company is busy on orders for various pottery plants and other lines of work. The Oxford Foundry & Machine Company has been incorporated with $50.000 capital stock and will erect a plant. The incorporators are: William A. Bartley, Oxford, Howard; L. Coas, West Orange; Barnard Brady, Lake Hopatcong. The engraving plant of the late Daniel J. Bechtel has been sold to Edward A. Seidenglanz and he will continue the enterprise successfully followed by Mr. Bechtel, except with some improvements in the way of machinery. Mr. Seidenglanz was for eleven years in the employ of the Horace E. Fine Company and is an expert in his line. The Bechtel management will take his name and he will engage in all branches of the business.

The American Standard Metal Products Corporation has purchased the plant of the Standard Fuse Corporation located along the Delaware river at Bordentown. The new concern will continue the manufacture of military and navel fuses, primers, hand grenades and gauges. The plant is now devoted entirely to gauge work, which, because of the great precision required, gives employment to many skilled mechanics. When the Bordentown plant of the Standard Fuse corporation was combined with that at Paulsboro a portion of the plant at the former place was taken down and removed.

Leonard Sheet Metal Works, Inc., of Jersey City, has filed an amendment with the secretary of state increasing its authorized capital stock to $500,000. The Raritan Copper Company has erected a one story manufacturing building.—C. A. L.

NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

The damage to the plant of the Pittsburgh Metal Spinning & Stamping Company, Pittsburgh, Pa., by fire did not exceed $1,000.

The Arneson Foundry Company, South and Exchange streets, Kenosha, Wis., is building an addition to its plant. The company manufactures brass and iron castings, and specializes in heavy brass work.

The Harris Laboratory, Inc., 26 Cortlandt street, New York, announce that they are prepared to serve the metal trades efficiently, especially in the practical analysis of brasses, bronzes, white metals, iron and steel.

Lomer G. Goodrich, manager of the Morse Plating Company, refinishers and electro-platers, 10-14 Park street, Pittsfield, Mass., for the past thirty years, has taken over the business and will continue it under the same name.

The Broadway Foundry Company, Cleveland, Ohio, is planning to build a new foundry. The company is in the market for a second-hand cupola about 72 inches in diameter. They operate a casting shop and grinding room.

The Bunting Bronze & Brass Company, Toledo, Ohio, has not taken over the plant of the Standard Die & Tool Company of that city as was reported, but has merely purchased a few machines from the Standard company.

The Dominion Forge & Stamping Company, Walkerville, Ontario, Canada, has completed the erection of a new forge shop which is estimated to have cost $16,000. The company operates a tool room, grinding room and stamping department.

The Peerless Tube Company, of Bloomfield, N. J., has purchased 100x120 feet alongside of its present factory and have begun the erection of an addition to its plant. This will give them the largest plant in the United States for the manufacture of collapsible tin tubes.

The United Brass Manufacturing Company, 3822 Hamilton avenue, Cleveland, Ohio, is improving and enlarging its plant. The additions are estimated to cost about $4,000. They operate a brass foundry, brass machine shop, tool and grinding rooms, also plating and polishing departments.

Landers, Frary & Clark, manufacturers of cutlery and hardware, New Britain, Conn., are receiving bids for the erection of an addition to its plant. The company operates a brass and aluminum foundry, brass machine shop, spinning, stamping, tinning, soldering, plating, polishing, japanning and lacquering departments.

The A. W. Wheaton Brass Works, 157 New Jersey Railroad avenue, Newark, N. J., manufacturers of builders' hardware, is having constructed a one-story, 33 x 50 feet, brass foundry. Besides a brass foundry the company operates a brass machine shop, tool and grinding rooms, casting shop, also plating, polishing and lacquering departments.

The Munning-Loeb Company, Matawan, N. J., manufacturers of electroplating and buffng apparatus and supplies, has opened an office at 709 Marion Building, 1270 West 3rd street, Cleveland, Ohio. This office is in charge of Frank H. Bliss, who was for a number of years connected with the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

The Brass Fixture Company, Southington, Conn., report that the published statement that they would soon close their plant is not true, but mention, however, that they have given up the manufacture of complete lighting fixtures and are devoting all of their time to metal spinnings of various kinds which they will continue to manufacture.

Walter Johnston, of the Philadelphia Brass Company, Commercial Trust Building, Philadelphia, Pa., announces that the company has gone into the manufacture of steel tubing for aeroplanes and similar work. All sizes from 2-inch diameter down will be manufactured. The company has taken contracts covering the next two years for producing these tubes.

The William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa., is erecting three shop additions to its plant at East Richmond and Norris streets, to cost about $35,000. The company operates a brass, bronze and aluminum foundry, brass machine shop, tool room, grinding room, galvanizing, brazing, tinning, soldering, polishing and lacquering departments.

The Spencer Wire Company, Worcester, Mass., has begun the erection of a two-story addition, 51 x 60 feet. The company states that this addition is simply to increase space and that very little new equipment will be required. Among the departments operated by this company are tool and grinding rooms, stamping, tinning, plating, polishing, japanning and lacquering departments.

A news article appeared recently in the newspapers all over the country that one Anthony George was sentenced by Judge Howe, in Federal District Court, to a term of three years in the Federal Prison at Atlanta. The Syracuse Smelting Works of Brooklyn, N. Y., want it known that the criminal, Anthony George, is not to be confused with Anthony George of their company, who enlisted in the cavalry immediately upon the entrance of the United States into the war, and is now in camp at Fort Riley, Kansas.

The F. H. Linthicum Bronze Foundry, 325 East Oliver street, Baltimore, Md., has been formed with F. H. Linthicum, who for the past two years has been sales manager of the American Bronze Company, Philadelphia, Pa., as proprietor, and W. C. Lilly, formerly of the Nelson Valve Company and of the American Manganese Bronze Company, Philadelphia, Pa., as superintendent. The foundry specializes in small castings, having facilities for production in large quantities and with a capacity for castings as large as 500 pounds each.

INCREASE IN CAPITAL STOCK

The Buckeye Iron and Brass Works, Dayton, Ohio, has increased its capital stock from $75,000 to $200,000. They operate a brass, bronze and aluminum foundry, brass machine shop, tool and grinding rooms, casting shop, plating, polishing and japanning departments.

SERVICE OVERSEAS

Metalworkers are wanted for early service overseas. The men in the front line trench need the help and co-operation of skilled men back of the lines, and metalworkers are wanted at once for the Enlisted Ordnance Corps, National Army.

Uncle Sam is calling on our trade to come across and help his fighting men. There is a lot of work to be done over there, and the call has gone out for metalworkers between the ages of 18 and 40 who want to do their bit and who know their job.

Modern war is a tremendous business, and the army that wins is the army which has the best equipment and the best men. The men are over there now—they are ready to go ahead, but they still need experts in our line to repair and maintain their equipment. There is a fine chance for every man who wants to help. Write to the Chief of Ordnance, War Department, Washington, D. C.

JOIN THE CIVIC RANKS AS A TECHNICAL GUILDSMAN

In connection with or in response to the call of the President for volunteers, the attention of all technical men, i. e., men skilled in any line of science or mechanical or electrical or chemical or ordnance or explosives or mining or ship building or railroad or motors or metallurgy or building of aeroplanes or water supply or sanitation, etc., is especially invited to the need of the army for such (young) men—aged 18 to 40—in sundry branches of technical troops, concerning which write for literature to Major J. E. Bloom, U. S. A., 266 Market street, Newark, N. J.

Any technical "men who are exempt" or who from any cause cannot "volunteer," can yet efficiently co-operate by forming Technical Patriotic Educational Guilds in their several industries or home neighborhoods, especially to look after the welfare of their men in the service, and to give them the opportunity of obtaining technical assistance, opinions and advice from home, in any war industry, from time to time.

NEW JERSEY ZINC COMPANY'S REPORT

The report of the New Jersey Zinc Company, New York, for the third quarter of the current year shows that owing to the lower prices for zinc and the greatly increased federal taxes the company is earning materially less than in 1916. In that year it paid regular and extra dividends of 76 per cent. all told. For eleven months of this year it distributed about 46 per cent. In 1915 the company declared a stock dividend of 250 per cent. when it raised its capital from $10,000,000 to $35,000,000. All through the war New Jersey zinc held a favored position not only because of the high price which its better grade of the metal commanded abroad, but at home. Common zinc is now only quoted around 7⅝ cents a pound, as compared with nearly 50 per cent. more than that last year at the corresponding period. Net earnings of the company for the third quarter of the year, after taxes and depreciation allowances were taken into account, amounted to $5,593,985, as compared with $8,304,511 in the same period of 1916, a drop of $2,710,526. The company's plants are running at full capacity and it has little stock on hand. The company recently awarded a contract to H. M. Krumbhaar for a new laboratory to cost $200,000.

INCORPORATIONS

Business organizations incorporated recently. In addressing them it is advisable to include also the names of the incorporators and their residence. Particulars of additional incorporations may frequently be found in the "Trade News" columns.

To manufacture hardware, cutlery, etc.—The Burroughs-Baldwin Company, 87 Warren street, New York. Capital, $20,000. Incorporators: C. R. Frazer, W. C. Burroughs and D. W. Baldwin.

To Manufacture Zinc Products.—American Zinc Products Company, Warren, Ohio. Capital, $1,000,000. Incorporator, D. W. Kerr. The company is building a sheet zinc rolling mill plant, consisting of ten stands of mills at Greencastle, Ind.

To manufacture brass and melting furnaces, ore pulverizers, blowers and other equipment.—The Iler Foundry & Manufacturing Company, Cleveland, Ohio, has been incorporated with a capital stock of $30,000 by F. M. Iler and others, to take over the business of the Iler Company. An addition, 30x50 feet, is being erected to the plant.

To manufacture hardware specialties.—The Hardware Specialties Manufacturing Company, Springfield, Ohio, has been incorporated for $10,000 to take over the business of the Hardware Specialties Company, a co-partnership between J. B. Gaines and R. L. McIntire, which was organized in September, 1915. The officers of the new company are: C. J. Tuttle, president; Donald Kirkpatrick, vice-president; H. B. Hayward, treasurer; R. L. McIntire, secretary and J. B. Gaines, general manager.

To manufacture electric furnaces and Bario metal.—The Bario Metal Corporation, 167 West 18th street, New York, N. Y. Capital, $90,000. Incorporators: Paul de Miles, president; N. Berbschleb, vice-president and treasurer, and H. Jenkins, secretary. The company will manufacture electric furnaces and a patented acid resisting metal known as Bario metal and operates a smelting and refining department, foundry, tool and grinding room, casting shop, also spinning, brazing, soldering and polishing departments.

INQUIRIES AND OPPORTUNITIES

Under the directory of "Trade Wants" (published each month in the rear advertising pages), will be found a number of inquiries and opportunities which, if followed up, are a means of securing business. Our "Trade Want Directory" fills wants of all kinds, assists in the buying and selling of metals, machinery, foundry and platers' supplies, procures positions and secures capable assistants. See Want Ad. pages.

PRINTED MATTER

Mineral Foote-Notes—The November issue, which is No. 11, Volume 1, of Mineral Foote-Notes issued by the Foote Mineral Company, Philadelphia, Pa., is devoted to "Chromium: Its Ores and Uses," by Dr. Heinrich Ries and considerable valuable information relating to chromium and its occurrence is given, including a list of its ores and alloys whose analyses are also published. The book also contains November prices of the various mineral compounds handled by the Foote Mineral Company.

Tumblers and Dust Arresters—Catalog No. 132, superseding No. 120, has been issued by the Whiting Foundry Equipment Company, Harvey, Ill. This particular catalog, consisting of twenty pages, is devoted entirely to tumblers and dust arresters for use in foundries and finishing rooms. Among the machinery illustrated and described are three classes, A. B. C., of tumblers, dry cinder mills and improved dust arresters with screen cleaning devices. Copies of the catalog may be had upon request.

CATALOG EXHIBIT

An exhibition of every kind of catalog may be seen at The Metal Industry office, 99 John street, New York. The Metal Industry is prepared to do all the work necessary for the making of catalogs, pamphlets, circulars and other printed matter. Estimates will be furnished for writing descriptions, making engravings, printing, binding, for the entire job from beginning to end or any part of it.

METAL MARKET REVIEW

WRITTEN FOR THE METAL INDUSTRY BY W. T. PARTRIDGE.

DECEMBER 3, 1917.

COPPER.

Adjustment to war conditions and to the fixed price, 23.50c per pound, for copper, was fully under way during November and nearly all problems were settled; the industry having passed into control of the Copper Producers' Committee, working in combination with the War Industries Board. While no copper could be purchased for this year's delivery from large producers at the Government price, contracts for January next were placed.

With improved labor conditions at mines and smelters rapidly developing, increased refined production is assured and the general opinion of the trade seems to indicate that business, which has been at a standstill owing to unsettled conditions, will soon be running smoothly again.

TIN.

Scarcity of spot metal and the highest prices ever recorded were the prominent features of interest in the tin market during November. From the October closing price, 66c per pound, advances were made fractionally during the early days, but from 1c to 2c per pound at a single jump, later, until 80c per pound was reached on November 22—a total price of 14c per pound for the month on Straits metal. Other grades of tin, notably Chinese No. 1 and English Lamb & Flagg 99%, were in good demand at higher prices, 3½c to 4c per pound, to 67.50-68.00c by the close of the month. Banca tin was unobtainable.

Late in the month a bulletin was issued by the sub-committee on tin of the American Iron and Steel Institute, covering regulations for the importation of pig tin, which it is believed will restore normal conditions in the trade as soon as adjustment to the new rules can be made. Arrivals of tin at Atlantic ports were 1,185 tons, with 4,100 tons reported afloat from the Far East and from Europe.

SPELTER.

The spelter market during November was marked by somewhat improved conditions, a firmer tone becoming evident upon prospective Government buying, which was indicated in the placing of large shell orders requiring different grades of spelter. Estimates based upon these orders indicate Government requirements of high grade spelter amounting to 100,000,000 pounds, 25,000,000 pounds of which have been purchased. Prices, after declining ½c per pound from 7.80c New York, 7.62½c East St. Louis, in the first week, not only recovered the lost fraction, but advanced to 7.92½-8.05c New York, 7.75c-7.87½c East St. Louis by the end of the first fortnight, after which there was no change. Zinc ore was steady at $57.50 to $72.50 per ton.

LEAD.

Strength and activity with large buying were notable in the lead market during the first half of November with rising prices. Two advances made by the leading producer, one of ½c on November 5th, the other ¼c two days later, carried the official base of the "trust" to 6.25c New York, and 6.17½c East St. Louis, while the outside market had advanced to 6.37½-6.62½c New York, 6.25-6.37½c East St. Louis. The total rise for the month was ¾c from 6.00c New York, 5.87½c East St. Louis at the close of October. During the second half of the month prices were firm and unchanged, but business transacted was in smaller volume.

Lead ore advanced twice: $5 to $65 the first time and $10 to $75 by the middle of the month, after which no change occurred.

ANTIMONY.

The November antimony market opened with a stronger tone than for some time; pressure to sell being less urgent in view of hoped-for Government buying, which it was expected would follow the placing of large contracts for shells. As time passed, however, these hopes were not realized, and with large stocks of metal in store, prices had receded ⅜c on prompt and November metal to 13.62½-13.37½c by November 12th, with business transacted confined to jobbing lots. By the 23rd the improved demand for 25-ton lots had caused an advance to 14.00c, but importers were still unable to do business, the price being 1c below cost of importation. In the next few days a further rise of ¼c carried prices upward to the level of November 1st, 14.00-14.50c, duty paid, for prompt and December metal.

ALUMINUM.

The recession in prices for aluminum, due to a well-stocked market and lack of demand, which has been in progress since last May, continued in November to 35.00-37.00c for No. 1 virgin 98-99%; 33.00-35.00c for 98-99% pure remelted; 25.00-27.00c for No. 12 alloy remelted on November 2nd. Due to some export business, however, these prices were stiffened at the close of the month one cent on each variety.

SILVER.

The need of silver for coinage purposes experienced by all governments is responsible for the negotiations which are now under way between the United States and Great Britain, on the one hand, and the silver producers on the other, through which it is hoped to make satisfactory arrangements for the government's 1918 requirements of silver. During November there was a continuous decline in prices from 89¾c per ounce, on November 1st, to 84¼c at the close, a total of 5½c per ounce for the month.

QUICKSILVER.

The active demand for quicksilver is interesting investigators in the development of new supplies. Prices in November advanced from $100 per flask to $110 per flask by the 26th, after which they were steady.

PLATINUM.

The demand for platinum continued in steady volume during November, maintaining prices at the same level that has prevailed since last March, namely, $105 for pure and $111 for 10% iridium.

OLD METALS.

Conditions in the old metals market, after drifting early in November, because of the unsettlement due to price-fixing in the major metals, gradually strengthened, being decidedly improved at the close, with prices up ¼c to 5c—the latter gain being on block tin pipe—on coppers, heavy brass, and No. 1 composition turnings, cocks and faucets, clean red car boxes, solder joints, old sheet aluminum, heavy lead and tea lead.

WATERBURY AVERAGE

The average prices of Lake Copper and Brass Mill Spelter per pound as determined monthly at Waterbury, Conn.:

Lake Copper, 1916—Average for year, 28.77. 1917—January, 32.25. February, 35.25. March, 35.50. April, 32.75. May, 32.00. June, 32.50. July, 30.875. August, 39.00. September, 27.25. October, 27.00. November, 23.50.

Brass Mill Spelter, 1916.—Average for year, 17.725. 1917—January, 13.05. February, 13.80. March, 13.45. April, 11.85. May, 11.05. June, 10.85. July, 10.55. August, 10.05. September, 9.80. October, 9.75. November, 9.65.

NOVEMBER MOVEMENTS IN METALS

	Highest	Lowest	Average
COPPER:			
Lake	....	Market Nominal	23.50*
Electrolytic	....	Market Nominal	23.50*
Casting	....	Market Nominal	23.50*
TIN	81.00	66.00	74.425
LEAD	6.62½	6.12½	6.444
SPELTER	8.17½	7.67½	7.903
ANTIMONY	14.37½	13.62½	13.90
ALUMINUM	38.00	35.00	36.85
QUICKSILVER (per flask)	$115.00	$100.00	$102.75
SILVER (cts. per oz.)	89⅜	84¼	85.891

*Government price.

Metal Prices, December 3, 1917

NEW METALS.

	Price per lb.
COPPER—DUTY FREE. PLATE, BAR, INGOT AND OLD COPPER. Manufactured 5 per centum.	
Electrolytic, carload lots, nom.. } Lake, carload lots, nominal.... } Government price	23½
Casting, carload lots, nominal	23½
TIN—Duty Free.	
Straits of Malacca, carload lots	80.00
LEAD—Duty Pig, Bars and Old 25%; pipe and sheets.	
20%. Pig lead, carload lots	6.25
SPELTER—Duty 15%.	
Brass Special	8.125
Prime Western, carload lots, nominal	8.00
ALUMINUM—Duty Crude, 2c. per lb. Plates, sheets, bars and rods, 3½ per lb.	
Small lots, f. o. b. factory	45.00
100-lb. f. o. b. factory	41.00
Ton lots, f. o. b. factory	37.00
ANTIMONY—Duty 10%.	
Cookson's, Hallet's or American	Nominal
Chinese, Japanese, Wah Chang WCC, brand spot	14.125
NICKEL—Duty Ingot, 10%. Sheet, strip and wire 20% ad valorem.	
Shot or Ingots	50c.
ELECTROLYTIC—5 cents per pound extra.	
MANGANESE METAL	Nominal
MAGNESIUM METAL—Duty 25% ad valorem (100 lb. lots)	$2.25
BISMUTH—Duty free	$3.00
CADMIUM—Duty free	nominal $1.80
CHROMIUM METAL—Duty free	.75
COBALT—97% pure	$2.70
QUICKSILVER—Duty, 10% per flask of 75 pounds	$112.00
PLATINUM—Duty free, per ounce	$105.00
SILVER—Government assay—Duty free, per ounce	.84¼
GOLD—Duty free, per ounce	$20.67

INGOT METALS.

	Price per lb.
Silicon Copper, 10% according to quantity	49 to52
Silicon Copper, 20% " "	55 to60
Silicon Copper, 30% guaranteed. " "	60 to65
Phosphor Copper, guaranteed 15% " "	58 to65
Phosphor Copper, guaranteed 10% " "	50 to57
Manganese Copper, 30%, 2% Iron " "	69 to75
Phosphor Tin, guaranteed 5% " "	96 to98
Phosphor Tin, no guarantee " "	95 to97
Brass Ingot, Yellow " "	17½to19½
Brass Ingot, Red " "	25 to26¼
Bronze Ingot " "	24 to25½
Parsons Manganese Bronze Ingots " "	33½to35
Manganese Bronze Castings " "	40 to52
Manganese Bronze Ingots " "	26 to30
Phosphor Bronze " "	24 to30
Casting Aluminum Alloys " "	37 to38

OLD METALS.

Dealers' Buying Prices.	Dealers' Selling Prices.
22.00 Heavy Cut Copper	23.50
22.00 Copper Wire	23.50
19.00 Light Copper	21.00
21.00 Heavy Mach. Comp.	23.50
14.00 Heavy Brass	16.00
10.50 Light Brass	12.50
14.00 No. 1 Yellow Brass Turning	16.00
18.00 No. 1 Comp. Turnings	21.00
5.25 Heavy Lead	5.75
6.00 to 6.25 Zinc Scrap	6.25 to 6.75
10.00 to 13.00 Scrap Aluminum Turnings	11.00 to 14.00
18.00 to 20.00 Scrap Aluminum, cast alloyed	20.00 to 22.00
26.00 to 28.00 Scrap Aluminum, sheet (new)	28.00 to 30.00
39.00 to 40.00 No. 1 Pewter	43.00 to 47.00
30.00 to 32.00 Old Nickel	34.00 to 36.00
22.00 to 23.00 Old Nickel anodes	25.00 to 26.00

PRICES OF SHEET COPPER.

Mill shipments (hot rolled) ..... 33c. base net
From stock ..... 35c. base net

Width.	LENGTH.	64 oz. and over.	32 oz. to 64 oz.	24 oz. up to 32 oz.	16 oz. up to 24 oz.	15 oz.	14 oz.	13 oz.	12 oz.	11 oz.
		Extras in Cents per Pound for Sizes and Weights Other than Base.								
Not wider than 30 ins.	Not longer than 72 inches.	Base	Base	Base	Base	½	1	1½	2	2½
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	½	1	2	3	4½
	Longer than 96 inches. Not longer than 120 inches.	"	"	½	1	2	3	5	7	
	Longer than 120 ins.	"	"	1	1½					
Wider than 30 ins., but not wider than 36 inches.	Not longer than 72 inches.	"	"	Base	Base	1	2	3	4	6
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	1	2	4	6	8
	Longer than 96 inches. Not longer than 120 inches.	"	"	1	2	3	4			
	Longer than 120 inches.	"	1	2	3					
Wider than 36 ins., but not wider than 48 inches.	Not longer than 72 inches.	"	Base	1	2	3	4	6	8	9
	Longer than 72 inches. Not longer than 96 inches.	"	"	1	3	4	5	7	9	
	Longer than 96 inches. Not longer than 120 inches.	"	"	2	4	6	9			
	Longer than 120 inches.	"	1	3	6					
Wider than 48 ins., but not wider than 60 inches.	Not longer than 72 inches.	"	Base	1	3	5	7	9	11	
	Longer than 72 inches. Not longer than 96 inches.	"	"	2	4	7	10			
	Longer than 96 inches. Not longer than 120 inches.	"	1	3	6					
	Longer than 120 inches.	1	2	4	8					
Wider than 60 ins., but not wider than 72 ins.	Not longer than 96 inches.	Base	1	3	8					
	Longer than 96 inches. Not longer than 120 inches	"	2	5	10					
	Longer than 120 inches.	1	3	8						
Wider than 72 ins., but not wider than 108 ins.	Not longer than 96 inches.	1	3	6						
	Longer than 96 inches. Not longer than 120 inches	2	4	7						
	Not longer than 120 inches	3	5	9						
Wider than 108 ins., but not wider than 120 ins.	Not longer than 120 inches.	4	6							

The longest dimension in any sheet shall be considered as its length.

CIRCLES, 8 IN. DIAMETER AND LARGER, SEGMENTS AND PATTERN SHEETS, advance per pound over prices of Sheet Copper required to cut them from ..... 8c.

CIRCLES LESS THAN 8 IN. DIAMETER, advance per pound over prices of Sheet Copper required to cut them from ..... 8c.

COLD OR HARD ROLLED COPPER, 14 oz. per square foot and heavier, advance per pound over foregoing prices ..... 1c.

COLD OR HARD ROLLED COPPER, lighter than 14 oz. per square foot, advance per pound over foregoing prices ..... 2c.

COLD ROLLED ANNEALED COPPER, the same price as Cold Rolled Copper.

ALL POLISHED COPPER, 20 in. wide and under, advance per square foot over the price of Cold Rolled Copper ..... 1c.

ALL POLISHED COPPER, over 20 in. wide, advance per square foot over the price of Cold Rolled Copper ..... 2c.

For Polishing both sides, double the above price.

The Polishing extra for Circles and Segments to be charged on the full size of the sheet from which they are cut.

COLD ROLLED COPPER, prepared suitable for polishing, same prices and extras as Polished Copper.

ALL PLANISHED COPPER, advance per square foot over the prices for Polished Copper ..... 1c.

Metal Prices, December 3, 1917

PRICES ON BRASS MATERIAL—MILL SHIPMENTS

In effect October 30, 1917.

To customers who buy 5,000 lbs. or more per year.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.30	$0.33	$0.35
Wire	.30	.34	.36
Rod	.28	.34	.36
Brazed tubing	.38	..	.43
Open seam tubing	.38	..	.43
Angles and channels	.38	..	.43

To customers who buy less than 5,000 lbs. per year.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.31½	$0.34½	$0.36½
Wire	.31½	.35½	.37½
Rod	.29½	.35½	.37½
Brazed tubing	.39½	....	.44½
Open seam tubing	.39½	....	.44½
Angles and channels	.39½	....	.44½

[Note.—Net extras for quality for both sections of above metal prices are not quoted due to the fluctuations in the price of zinc.—Ed.]

BARE COPPER WIRE—CARLOAD LOTS.

28c. per lb. base.

SOLDERING COPPERS.

300 lbs. and over in one order	39c. per lb. base
100 lbs. to 300 lbs. in one order	40c. " " "
Less than 100 lbs. in one order	41½c. " " "

PRICES FOR SEAMLESS BRASS AND COPPER TUBING.

From 1¼ to 3½ O. D. Nos. 4 to 13 Stubs' Gauge, — per lb.
Seamless Copper Tubing, — per lb.

For other sizes see Manufacturers' List.

Due to fluctuations of the metal market we are unable to quote these prices.

PRICES FOR SEAMLESS BRASS TUBING Iron Pipe Sizes.

Iron pipe sizes with price per pound.

⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5

Due to fluctuations of the metal market we are unable to quote these prices.

PRICE LIST OF IRON LINED TUBING—NOT POLISHED.

Due to fluctuations of the metal market we are unable to quote these prices.

PRICES FOR TOBIN BRONZE AND MUNTZ METAL.

Tobin Bronze Rod	35½c. net base
Muntz or Yellow Metal Sheathing (14" x 48")	32c. " "
Muntz or Yellow Metal Rectangular sheets other than sheathing	35c. " "
Muntz or Yellow Metal Rod	33c. " "

Above are for 100 lbs. or more in one order.

PLATERS' METALS.

Platers' bar in the rough, 65c. net.

German silver platers' bars dependent on the percentage of nickel, quantity and general character of the order.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturer.

PRICES OF NICKEL ANODES.

85 to 87% purity	52½c. per lb.
90 to 92% "	55c. " "
95 to 97% "	57½c. " "

PRICE SHEET FOR SHEET ALUMINUM—B. & S. Gauge.

Base price, 60c.

We are unable to quote these prices, but they can be had upon application to manufacturers and dealers.

PRICE LIST SEAMLESS ALUMINUM TUBING.

We are unable to quote these prices, but they can be had on application to manufacturers and dealers.

PRICE LIST FOR ALUMINUM ROD AND WIRE.

We are unable to quote these prices.

PRICES OF SHEET ZINC.

Duty, sheet, 15%.

	Cents per lb.
Carload lots, standard sizes and gauges, at mill	19 cent basis, less 8%
Casks, jobbers' prices	20c.
Open casks, jobbers' prices	20.5c.

BASE PRICE GRADE "B" GERMAN SILVER SHEET METAL.

Quality.	Net per lb.	Quality.	Net per lb.
5%	42½c.	16%	47c.
8%	43½c.	18%	47½c.
10%	43¾c.	20%	49¼c.
12%	45½c.	25%	57c.
15%	49c.	30%	62½c.

GERMAN SILVER WIRE.

Quality.	Net per lb.	Quality.	Net per lb.
5%	44c.	15%	52c.
8%	46c.	16%	52½c.
10%	48c.	18%	54½c.
12%	50c.	30%	70c.

The above Base Prices are subject to additions for extras as per lists printed in Brass Manufacturers' Price List and from such extras 50% discount will be allowed. The above base prices and discounts are named only to wholesale buyers who purchase in good quantities. Prices on small lots are considerably higher.

PRICES FOR SHEET BLOCK TIN AND BRITANNIA METAL.

Sheet Block Tin—18" wide or less. No. 26 B. & S. Gauge or thicker. 100 lbs. or more. 5c. over Pig Tin. 50 to 100 lbs. 7c. over, 25 to 50 lbs. 8c. over, less than 25 lbs. 10c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 2c. over Pig Tin. 50 to 100 lbs. 4c. over, 25 to 50 lbs. 5c. over, less than 25 lbs. 8c. over.

Above prices f. o. b. mill.

Prices on wider or thinner metal on request.

PRICES OF SHEET SILVER.

Rolled sterling silver .925 fine is sold according to gauge quantity and market conditions. No fixed quotations can be given, as prices range from — below to — above the price of bullion.

Rolled silver anodes .999 fine are quoted at ——— above the price of bullion. Manufacturers state that as silver is selling at a premium at the present time they are unable to give any quotation.

PRICES OF SOME METAL INDUSTRY CHEMICALS AND MATERIALS.

Phosphorus—Duty free, according to quality	$1.70
Nickel Salts, Single bbl	14c. per lb.
Nickel Salts, Double bbl	11c. " "
Sodium Cyanide	37c. " "
Silver Nitrate, 100 oz. lots	55.53c. per oz.
Sodium Carbonate (Sal Soda)	.05c. per lb.

PRICES FOR COTTON BUFFS.

Open buffs, per 100 sections (nominal).

12 inch, 20 ply, 64/68, cloth	base $42.10
14 " 20 " 64/68, "	" 55.85
12 " 20 " 84/92, "	" 47.35
14 " 20 " 84/92, "	" 61.70

Sewed buffs per pound.

Bleached and unbleached	base 36c.
Colored	" 33c.

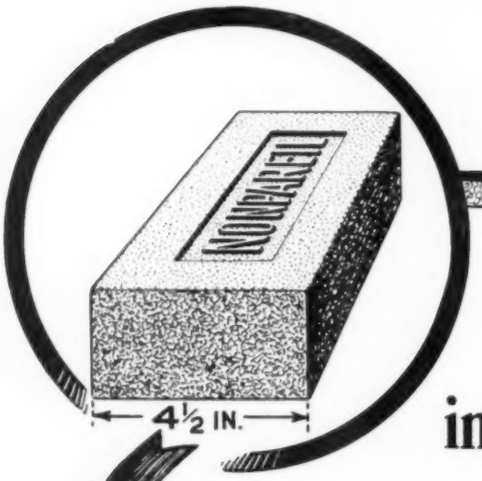
PRICES FOR FELT WHEELS.

White Spanish—

Diameter.	Thickness.	Price.
6 to 10 inch	1 to 3 inch	$2.60 per lb.
10 to 16 "	1 to 3 "	2.50 " "
6 to 16 "	Under 1 "	2.75 " "
Over 16 "	Over 3 "	2.60 " "

Mexican Wheels—

Diameter.	Thickness.	Price.
6 to 10 inch	1 to 3 inch	$2.50 per lb.
10 to 16 "	1 to 3 "	2.40 " "
6 to 16 "	Under 1 "	2.65 " "
Over 16 "	Over 3 "	2.50 " "



Ten Times as Efficient in Stopping Radiation Loss

One 4½-inch course of Nonpareil Brick installed in the walls of a furnace or boiler setting will equal the heat saving efficiency of 45 inches of common brick or fire brick. It is obvious that it would be impractical to build a wall 45 inches thick in order to save radiation loss. The only way to insure Nonpareil efficiency is to install

Nonpareil Insulating Brick

For Furnaces, Ovens, Boiler Settings, etc.

One 4½-inch course built in the walls, arches and bottoms would eliminate fully 60% of the radiation waste. The amount of fuel saved would pay for the brick in less than a year and return 100% on the investment for a long time thereafter.

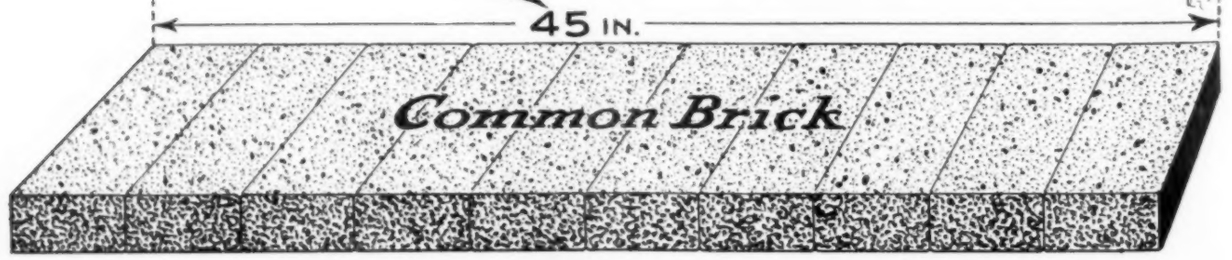
Nonpareil Brick are composed principally of diatomaceous earth, one of the best nonconductors of heat known. They weigh only 1½ pounds for the 9 x 4½ x 2½ inch size, yet are strong enough to bear a crushing load of ten tons to the square foot. They are also able to withstand temperatures up to 1650° without shrinkage or change of form.

Why not investigate the saving that Nonpareil Insulating Brick would make in your plant? Literature, free upon request, will give you some interesting information. A sample brick will also be included. Write today.

Armstrong Cork & Insulation Company

116 Twenty-fourth Street Pittsburgh, Pa.

Also manufacturers of Nonpareil High Pressure Covering for steam lines; Nonpareil Corkboard Insulation for cold storage rooms; Nonpareil Cork Covering for cold pipes; Nonpareil Cork Machinery Isolation for deadening the noise of machinery; and Linotile for floors in offices and residences.



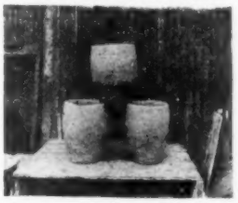
Relining gas producer with Hytempite and crushed old fire brick.

Forms in place, reverberatory smelting furnace, ready for lining.

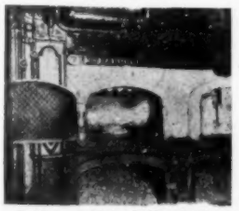
Mixing Hytempite with old crushed fire brick for making rammed-in lining for smelting furnace.

Ramming-in lining, smelting furnace.

Crucible before repairing and surfacing with Hytempite.



Same crucibles after being repaired and resurfaced with Hytempite.



Bridge wall in boiler laid with Hytempite.

THINGS YOU SHOULD KNOW ABOUT

HYTEMPITE

What is it?

HYTEMPITE is a scientifically compounded refractory plastic material for bonding fire brick and kindred uses.

What does it do?

HYTEMPITE forms a lasting union between the materials to be joined, sets at normal temperatures and retains its strength regardless of the heat it is subjected to up to about 3100° F. (1700° C.) or a temperature at which the best quality fire brick loses its strength and becomes soft.

Why is it better than fire clay?

HYTEMPITE is better than fire clay because fire clay and water has no binding strength, does not support the brick work or knit together the materials with which it is used, becomes loose from constant expansion and contraction, disintegrates or falls out forming crevices or cracks and does not maintain a gas or air tight structure.

Does it depend on heat for a bond?

No. HYTEMPITE air sets at normal temperatures, making a wall of uniform strength throughout.

Will it stop or prevent air and gas leaks?

Yes, HYTEMPITE will not only stop these leaks, but will withstand the expansion and contraction caused by heat without loosening.

What proves its merit?

Over 75% of its sales are repeat orders.

What are some of its uses?

1. For laying fire brick and tile.
2. For tightening old walls and arches, sealing openings in new walls, stacks, etc., to make them air-tight, lining doors, etc.
3. Hot patching in furnaces, gas retorts, etc.
4. Making special tile and shapes with crushed old fire brick or carborundum fire sand.
5. Making rammed-in linings with your crushed old fire brick or carborundum fire sand.
6. Bonding new courses or a veneer of fire brick to old walls.
7. Preventing leaks between bricks and iron work.
8. As a wash for surfacing brick work.
9. As a grout diluted or neat, according to requirements.
10. For lining ladles.
11. For patching or building up tuyeres, etc., etc.

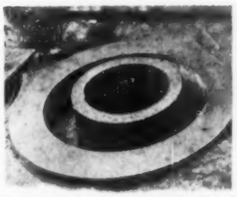
Who makes HYTEMPITE?

An organization that has had over twenty years' experience in furnace design, construction and operation and which understands what is required of a furnace cement and stands back of HYTEMPITE, **Furnishing Personal Service.**

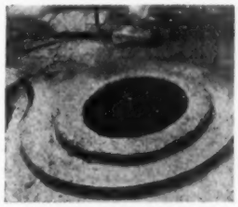
Quigley Furnace Specialties Co.

26 Cortlandt Street **New York**

Pit crucible furnace before lining.



Form in place, partially lined.



Pit crucible furnace relined with Hytempite and carborundum rammed-in.

Setting arch in small furnace with Hytempite.

Door before being repaired with Hytempite. Bricks falling out.

Furnace door repaired with Hytempite.

Shipping Hytempite.

M. P. E. Co. Overfired Furnaces

M. P. E. CO. TWIN CHAMBER FURNACE FOR ANNEALING BRASS IN SHEETS, COILS, RODS, ETC.

For the exacting requirements of U. S. and other Government work and for private plants where the nature of the work makes the maintenance of an accurate, uniform, controllable temperature essential.

Standard and Special designs for all heat treating purposes, annealing, hardening, tempering, carbonizing, etc., using oil or gas as fuel.

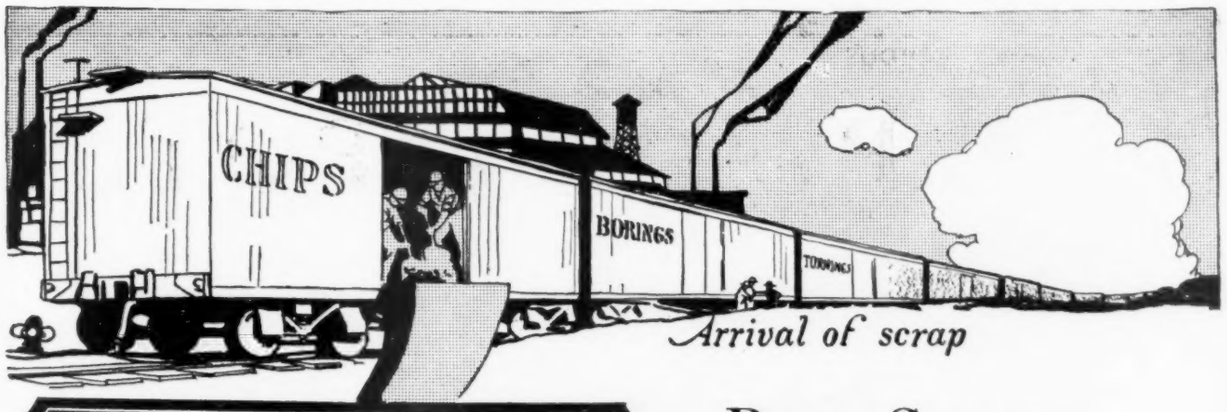
Read our Bulletins No. 1-6—New Edition.

METALS PRODUCTION EQUIPMENT COMPANY

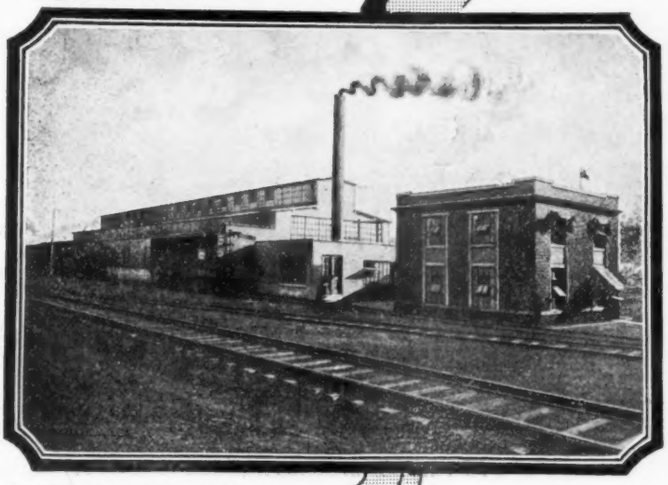
Successors to Quigley Furnace and Foundry Company

Sales Offices: 165 Broadway, New York **Works: Springfield, Mass.**

Designers and Builders of Overfired Accurate Temperature Furnaces (Oil or Gas Fuel). Grey Iron Castings. Powdered Coal Equipment. Brass Rolling Mill Products



Arrival of scrap



Our Waterbury Plant which is producing over two million pounds of Briquet-Ingots per month

Brass Scrap Conversion Service

A simple solution of the problem of putting brass chips and other finely divided brass scrap to useful use.

You ship this waste to us in barrels, bags, boxes —*any* way.

We put it through unique purification processes that remove the iron and other foreign substances. Then we *impact* the purified chips into

Briquet-Ingots

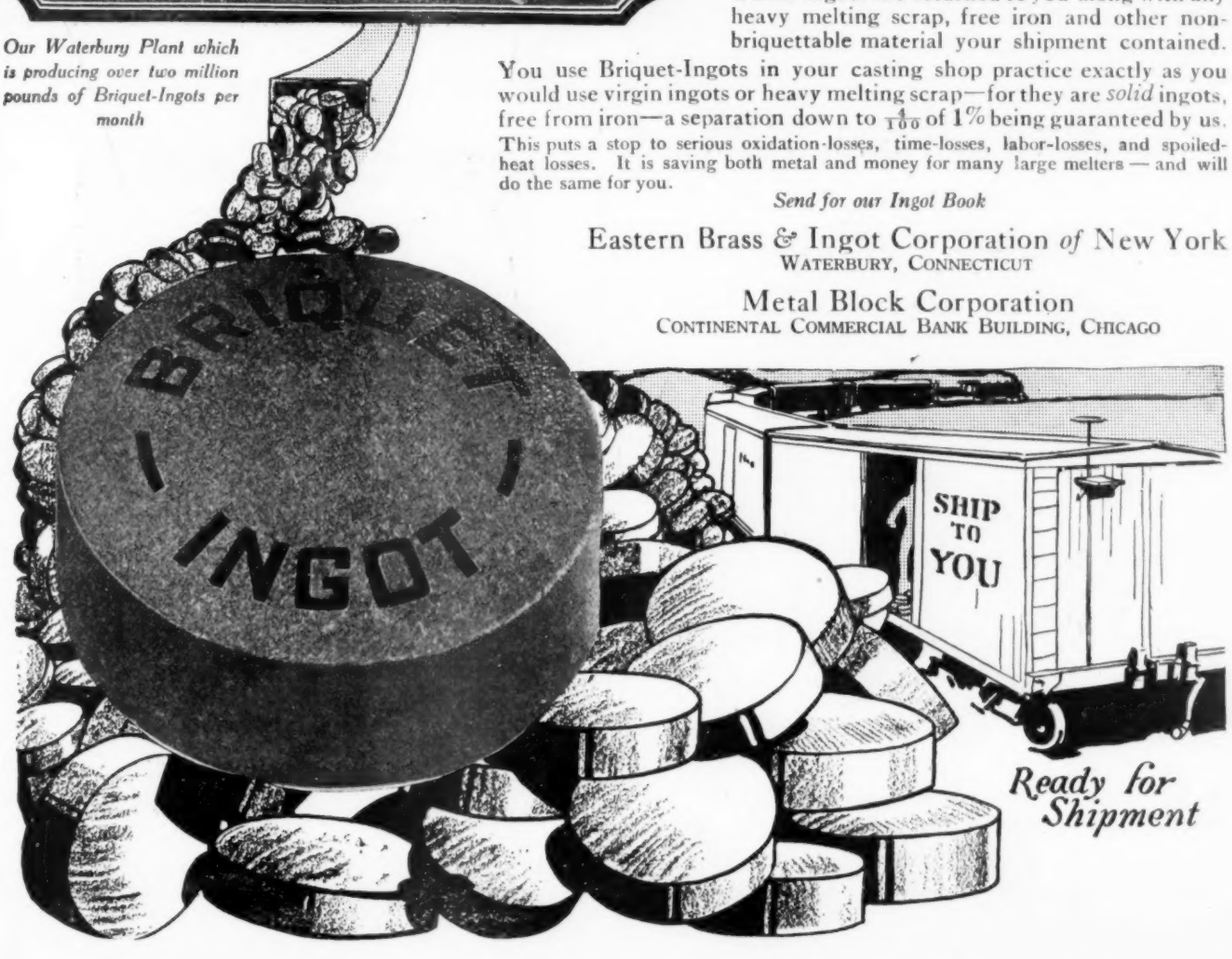
These ingots are returned to you along with any heavy melting scrap, free iron and other non-briquettable material your shipment contained.

You use Briquet-Ingots in your casting shop practice exactly as you would use virgin ingots or heavy melting scrap—for they are *solid* ingots, free from iron—a separation down to $\frac{1}{100}$ of 1% being guaranteed by us. This puts a stop to serious oxidation-losses, time-losses, labor-losses, and spoiled-heat losses. It is saving both metal and money for many large melters — and will do the same for you.

Send for our Ingot Book

Eastern Brass & Ingot Corporation *of* New York
WATERBURY, CONNECTICUT

Metal Block Corporation
CONTINENTAL COMMERCIAL BANK BUILDING, CHICAGO



Ready for Shipment

How Boronic Products Saved A Firm From Going Out of Business

Patents Pending

Patented

Clinching Evidence

from

A MAN OF THE MELTING POT

Some days since we received a letter from a MAN OF THE MELTING POT, who SAVED HIS COMPANY FROM QUITTING BUSINESS, because they wanted to do the very unusual thing of CASTING BRASS ROD WITH THE SAME TENSILE AND ELONGATION AS OBTAINED BY ROLLING.

The Company had called in the EXPERTS (?) and, AFTER WASTING A LOT OF TIME AND MONEY ON THEM, DECIDED TO GIVE THEIR MAN OF THE MELTING POT A SHOW.

Now, this letter, quoted in this ad, is not intended in the least to convey the impression that EXPERTS are not SOMETIMES as capable as men of the melting pot, but it is frankly intended to say that the EXPERT who knows it all (?) and who frequently has all his knowledge from the text-book (?) DOES NOT BEGIN TO KNOW WHAT THIS MAN OF THE MELTING POT KNOWS. He knew enough to "prove all things and to hold fast" (FOR HIS FIRM) "to that which is good," regardless of what is written.

THIS MAN OF THE MELTING POT had heard a great deal about BORONIC PRODUCTS, and after giving the same an honest try-out, he set out to save his firm and to prove to his employers that he could not only DO WHAT HE CLAIMED, BUT THAT, BASED UPON HIS CONFIDENCE AND KNOWLEDGE IN BORONIC PRODUCTS, HE COULD GET GOOD BUSINESS FOR THEM.

He writes: "Until recently, they would take the advice of every Tom, Dick and Harry that came along, and would think nothing of paying a large sum to so-called experts, who would come along and guarantee to set them right without inquiring about the trouble. * * *

"To-day I am making rod with your No. 7, which has a tensile strength of 63,000 pounds average and 35% elong, average, and this is cast rod only—not drawn or scalped or worked in any way—and I challenge any man to-day to accomplish the same results without the use of your alloy, or one equally as good, if such a thing is possible. * * *

"Had it not been possible to obtain the results I have with the use of your No. 7, they simply could not and would not have been able to obtain the good business they now have for approximately 500,000 lbs. of brass forgings to be made from brass rod, unless, of course, they could have spent thousands of dollars to first install a standard rod rolling and drawing mill. * * *

"I want to be fair enough to distribute the credit to all who deserve it, and surely the AMERICAN BORON PRODUCTS CO. deserves a portion.

"It is not only the brasses that I have been able to make records with, but bronzes, copper and aluminum castings."

MORAL: MEN OF THE MELTING POT and EXPERTS WHO HAVE THE HONEST INTEREST OF YOUR EMPLOYERS AT HEART, "GO AND DO LIKEWISE."

It is no exaggeration to say that there are many MEN OF THE MELTING POT who are SUPPRESSED and HELD DOWN and WHO COULD MAKE GOOD FOR THEIR EMPLOYERS, IF THEY KNEW THAT THEY DARED OVER-RIDE THE INFLEXIBLE RULES AND LAWS LAID DOWN BY THOSE OVER THEM.

We are not minded to incite dissension and discord, but we invite the man who would like to HELP HIS EMPLOYER AND THOSE WHO WOULD SHOW THE WAY TO FAIR-MINDED EXPERTS TO CORRESPOND WITH US and LET US HELP THEM TO HELP THEIR EMPLOYERS TO BE PROGRESSIVE AND GROWINGLY HELPFUL IN THE ERA OF THE WORLD'S REDEMPTION AND UPLIFT.

American Boron Products Company, Inc.

Reading, Pa., U. S. A.

Sole Manufacturers of Boronic Products

Reference is requested to our extensive advertisements in the preceding numbers of this publication

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National Alloys Limited, London, England.
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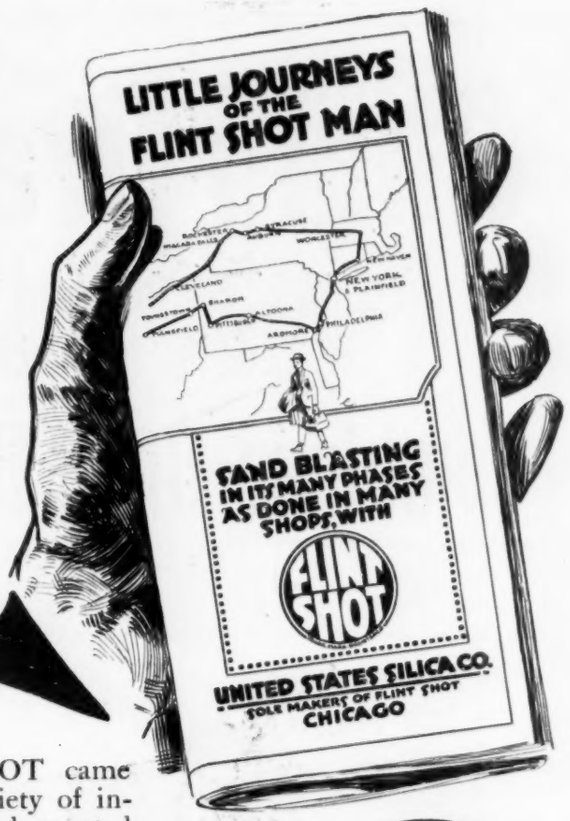
A Practical Text Book On Sand Blasting FREE For The Asking.



DEMAND for FLINT SHOT came from such a surprising variety of industries besides those we had counted upon, that we saw the need of detailed knowledge of actual shop practice.

We, therefore, made a first hand study of Flint Shotting in plants of many kinds, from Illinois to Massachusetts, and developed a vast fund of useful information—carefully authenticated—for all users of sand blast; as well as for all industries still clinging to the slow and costly practice of pickling, tumbling, wire brushing, etc.

The "*Little Journeys of the FLINT SHOT Man*" have now been put into a Book, the only approach to a text book on sand blasting thus far written. It is of interest in every industry where metal surfaces are cleaned, by whatever process or material.

The book is yours for the asking.

FLINT SHOT
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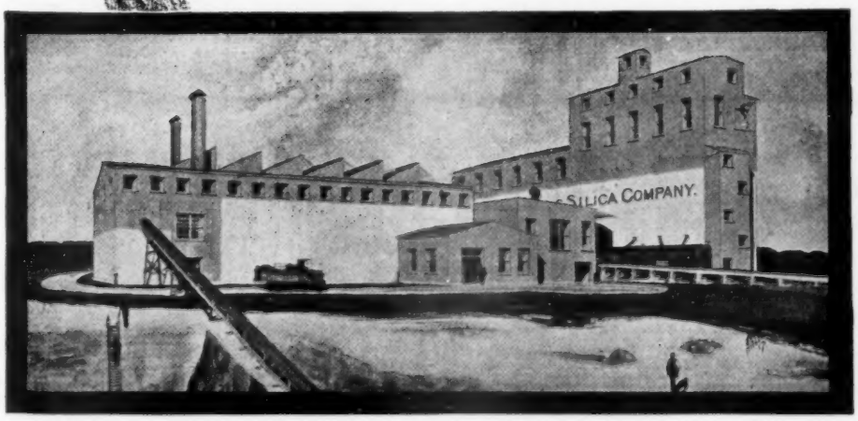

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SEND YOUR SPECIFICATIONS SAMPLES OR BLUE PRINTS HERE

With our Associated Machine Shops, Foundries, Assembling and Manufacturing Plants—located in all parts of the United States—with *Equipment comprising thousands of Machine Tools, and employing thousands of Skilled Mechanics, and the necessary complement of Managers, Designers and Draughtsmen—we can guarantee*

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FOUNDRY WORK

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PATTERN WORK

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PROMPT ATTENTION GUARANTEED

CO-OPERATIVE ENGINEERING COMPANY INC

50 CHURCH STREET, NEW YORK CITY

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., required by the Act of Congress of August 24, 1912, of THE METAL INDUSTRY, published monthly at New York, N. Y., for October 1, 1917.

STATE OF NEW YORK } ss.
COUNTY OF NEW YORK }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Palmer H. Langdon, who, having been duly sworn according to law, deposes and says that he is the publisher of THE METAL INDUSTRY, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Palmer H. Langdon, 99 John street, New York; Editor, Palmer H. Langdon, 99 John street, New York; Managing Editor, L. J. Krom, 99 John street, New York; Business Managers, Geo. W. Cooper and Thos. A. Trumbour, 99 John street, New York.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent. or more of the total amount of stock.) The Metal Industry Publishing Company, 99 John street, New York; Palmer H. Langdon, 99 John street, New York; L. J. Langdon, 99 John street, New York; Thos. A. Trumbour, 99 John street, New York; John B. Woodward, 99 John street, New York.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

THE METAL INDUSTRY, PALMER H. LANGDON, Publisher.

Sworn to and subscribed before me this 4th day of October, 1917.

[SEAL] O. B. LEWIS, Notary Public, Kings County Clerk No. 12.

Certificates filed: Kings County Register's No. 8014; New York County Clerk No. 54; New York County Register No. 8076.

(Commission expires March 30, 1918.)

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GENERAL OFFICE
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ADVERTISING DEPARTMENT

Schenectady, N. Y. Nov. 2, 1917.

Mr. G. Cooper, Adv. Mgr.
The Metal Industry,
99 John Street,
New York, N. Y.

Dear Sir:

We are glad to note the results of the audit of your circulation as shown by report received with your letter of October 29th. Evidently you appreciate fully the significance and value of such a report. We try to, and are guided very largely, in fact almost wholly, in the selection of new periodicals by their A.B.C. standing. It is becoming more and more apparent that to be an A.B.C. member the publisher must maintain a good business standing and that his relations with his subscribers must be on a mutually profitable basis or he will not keep them. This of course means more than numbers of subscribers. And an advertiser who has learned how to use A.B.C. reports must give extra consideration to that publisher who can show the best complete A.B.C. audited report.

It is our opinion that the chief benefits an advertiser can expect to derive from A.B.C. service is in the elimination of weak and inefficient publications rather than in avoidance of loss through dishonesty or mis-representation of business papers. Mis-information and dishonesty can be detected but lack of information and unsound business methods are hard to detect in time to avoid loss.

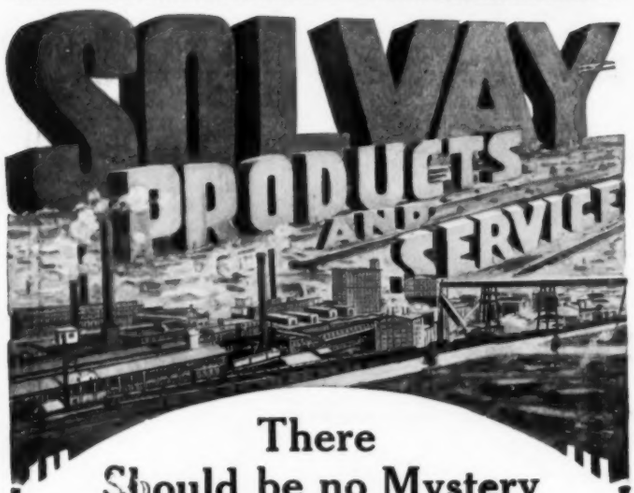
We congratulate you on the good business practices observed in the publication of the METAL INDUSTRY. One would naturally judge the editorial practices to be on an equally safe and sound basis.

Yours very truly,

F. H. GALE, ADVERTISING MANAGER,

FRD:LS

Per F. H. Davis



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Made by

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If you have never used

TRI-B BRAND **SULPHURETTE**

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Cleaning With Gasoline The Cause Of $16,000,000 Fire

Remember the recent big newspaper headlines of the great $16,000,000 explosion and fire at Kingsland, New Jersey, which originated in the gasoline tanks used for cleaning shells?

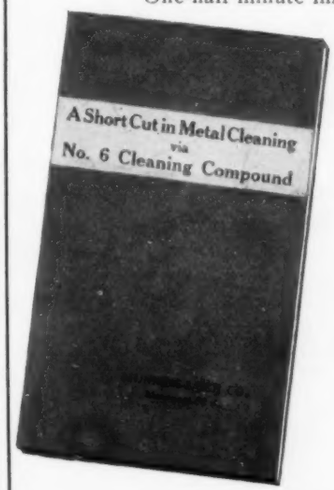
Those headline writers knew their business, but they didn't know that gasoline was not only dangerous, but more costly than other metal cleaners.

CONSIDER NO. 6 CLEANING COMPOUND

A No. 6 Cleaning Bath costs 4c. a gallon—gasoline costs 24c. a gallon. A No. 6 bath is little contaminated by the grease and dirt it removes—gasoline is quickly contaminated and loses its strength from the start. Consequently a No. 6 bath, materially lower in first cost, lasts two to three times longer than a gasoline bath and *No. 6 is neither inflammable nor explosive.* Its base is fish oil soap. It is neutral and does not affect the hands or clothing.

No. 6 is a special cleaner especially compounded for removing dirt, greases and mineral oils from metal articles and is pre-eminently suited for cleaning of all machine tool-made articles.

One-half minute immersion in a hot solution of No. 6 does the business—eliminating the lengthy alkali bath, benzine, gasoline and other chemical cleaners. It eliminates the scrub and scrub bench and does not tarnish or injure the finish.



Finally, No. 6 does not wear out because it does not combine chemically with the dirt and grease it removes. A No. 6 solution will give 2 to 3 times the effective service of any ordinary cleaner and then if allowed to cool and settle—the scum skimmed off and the solution drained off from the sediment, you have the No. 6 Cleaner but little contaminated, ready for the addition of the lost water and a little fresh No. 6 to make up the quantity.

Does No. 6 pay? It is at least worth trying. Tell us what and how you are cleaning, and we will tell you what No. 6 will do for you.

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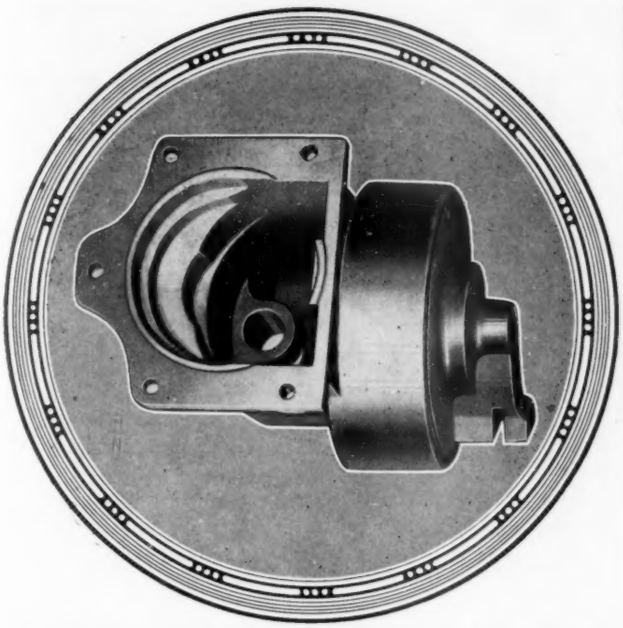

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The qualities essential to perfect die-castings are assured by the Stewart Process—accuracy—uniformity—strength—finish.

To be a source of economy, die-castings must combine all of these qualities. They must be delivered in a perfect, finished state.

Stewart-made die-castings are cast automatically — every one alike—100% perfect.

Unlimited facilities—rapid production—superior methods guarantee quick deliveries on large outputs.

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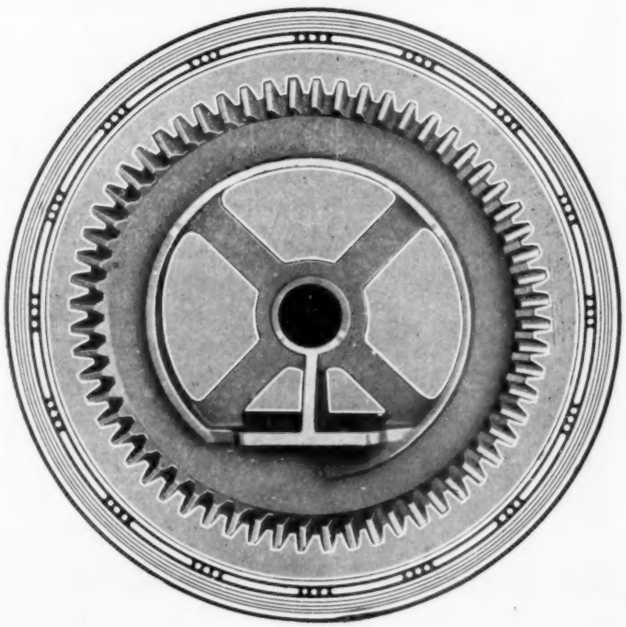

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Smelted direct from the exceptionally pure ores of northern New Jersey, this high-grade spelter under the brands of

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BRASS ROD A free-cutting Brass Rod for screw machine work. It is straight and free from cracks.
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Manufacturers of
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IN COILS FOR
DRAWING and STAMPING
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Will turn old and inferior scrap metals into castings as good as you can obtain by the use of prime virgin metals.

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To offset the continued increasing cost of materials and the scarcity of labor, use

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They eliminate unnecessary machining—save a great deal of labor—and mean more economical production.

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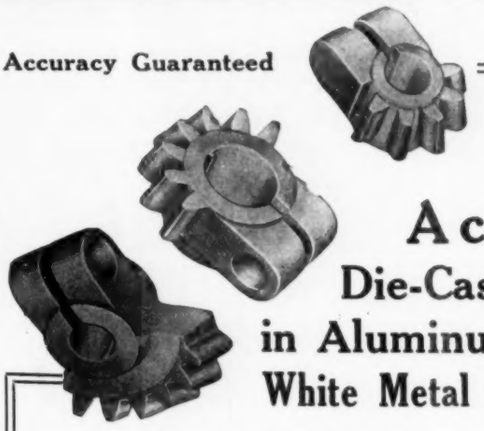

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FOR SALE—1 New Bliss No. 69-C Double Action Three Crank Press—never used. Complete with finger stop attachment, weight 3700 lbs. approximately. Blanking stroke 1½", drawing stroke 4". Will take blank 11" in diameter, draw punch 7½" diameter. Will draw and punch up to ⅞" high. Floor space over all 51" x 40". Weight of flywheel 900 lbs. Speed about 120 R. P. M. Round opening in bed, 8". Immediate delivery. Subject to prior sale. A bargain.

THE TORRINGTON MFG. CO.,
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FOUNDRY EQUIPMENT

FOR SALE—One Connersville positive rotary pressure blower, 3.3 cubic ft., $300.00. One No. 5 Roots positive rotary pressure blower, 19.6 cubic ft., $750.00. One 60" Schwartz Furnace, newly relined with brick, complete, in good condition (have blower, oil pump, motor, oil tank holds 1,000 gallons, used only three months). Will sell complete equipment for $2,000.00, immediate shipment, subject to prior sale. Address CONNERSVILLE, Care of THE METAL INDUSTRY.

ROLLS

FOR SALE—Set of rolls for Britannia metal, 12 inch diameter, 20 inches between housings. Good condition. Photo on request.

HARTFORD STERLING COMPANY,
24th & LOCUST STS., PHILADELPHIA, PA.

MACHINE SHOP

FOR SALE—At a big snap, machine shop, foundry, pattern shop and blacksmith shop; suitable for manufacturing. Easy terms to right parties. In one of the best cities in Manitoba, Canada. Address

MACHINE SHOP,
Care THE METAL INDUSTRY.

SPRING STEEL

FOR SALE—15,000 lbs. of .022 x 1" wide, Straw Temper Spring Steel, 23c. per lb. F. O. B. Chicago, terms 2% ten days. Samples on request. Address

STEWART PHONOGRAPH CORPORATION,
323 WELLS STREET, CHICAGO, ILL.

CARBON

FOR SALE—28 pieces of Carbon. One-half inch thick. Sizes 7½ x 12 inches and 12 x 15 inches, containing about 3,000 square inches. Highest quality. Address

B. W. G., Care THE METAL INDUSTRY.

SOFT STEEL

FOR SALE—100 tons Soft Steel, gauges 10, 11, 12, 13 and 14. Each gauge separate cut to lengths about 3 ft. Various widths 4 to 16 in. Also 50 tons gauges 7, 8 and 9. Various lengths 3 to 12 ft., 4 to 24 in. wide. Ready for immediate shipment from Shelton. Moderate prices. Address

S. LOCK CO., BOX A, SHELTON, CONN.

WHEEL BRUSHES

FOR SALE—Several hundred old tampico wheel brushes averaging about 9" in diameter with wooden hub 5" in diameter, 1-1½" hole, 2" face. Address

TAMPICO,
Care THE METAL INDUSTRY.

TUBE MACHINERY

FOR SALE—One set of tin tube machinery for casket hardware, three double buffing lathes and one 600 ampere plating dynamo.

GEO. C. FRAZIER,
1302 Sheffield Street, Pittsburgh, Pa.

OIL FIRED FURNACES

FOR SALE—6 J. P. Smith Foundry Co. for Aluminum, 5 Monarch Non-Tilting for Brass. Price, $150.00 each. Send for photographs.
LUCAS & SON, 10 Fox Street, Bridgeport, Conn.

Second hand polishing lathes and used rag wheels. For sale cheap.
WALSH'S SONS & CO., Newark, N. J.

Send in your FOR SALE and WANT ADVERTISING Copy for the Annual Review (January) Number of THE METAL INDUSTRY

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Highest Quality Ingot Metals
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WANTED—EQUIPMENT, ETC.

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EQUIPMENT

WANTED—About 50 flasks, 4 pin, 12 x 16 x 3", with holes for pouring upright. Also oil tank, 500 gallons or more, and 2 good, heavy vises. State price and condition.

P. O. BOX 110, NEW ROCHELLE, N. Y.

ROLLING MILL EQUIPMENT

WANTED—Various kinds of rolling mill machinery for breaking down and finishing monadium non-corrosive alloys (similar to nickel silver in working qualities).

THE MONADIUM COMPANY,
1111 Westminster Bldg., Chicago, Ill.

FOUNDRY EQUIPMENT

WANTED—Second-hand Brass Furnaces, Tumbling Barrels, Sprue Cutters, Core Ovens, Brass Foundry Equipment. Send full particulars to

J. S. McCORMICK COMPANY,
PITTSBURGH, PA.

COTTON BUFFS

WANTED—To buy second hand or used Cotton Buffs 6" to 10" Diameter, 5/8" hole. Address

COTTON BUFFS, Care THE METAL INDUSTRY.

INQUIRIES AND OPPORTUNITIES

Inquiries received by The Metal Industry for Metals, Machinery and Supplies. Further particulars may be obtained by addressing the inquiry number, care The Metal Industry. No charge for inserting these inquiries.

Inquiry 1917—We are in the market for a second-hand cupola about 72" in diameter.

Inquiry 1918—Where can we get cast metal novelties such as animals, figures, busts of prominent men, etc.?

Inquiry 1919—We intend erecting a new foundry. Please have equipment manufacturers send us their catalogues, prices and delivery dates.

Inquiry 1920—Please give us the names of firms manufacturing horizontal hydraulic presses of about 1,000 tons power, for drawing metals.

Inquiry 1921—We are in the market for brass working turret lathes, threading and tapping machines, milling machines and shaper, sensitive drill and riveting machine, and nickel plating and japanning plants.

Inquiry 1922—We have a large quantity of cold-rolled steel strips in coils to be electro galvanized every month. Where can we have it done?

Inquiry 1923—Who manufactures novelty goods such as desk sets, vases, and toilet articles?

Inquiry 1924—Who can successfully electro plate small carbon parts with duplex copper and nickel?

Inquiry 1925—Who manufactures soap powder for use in tumbling barrels?

Inquiry 1926—Where can stick phosphorus as used by brass foundries be purchased?

Inquiry 1927—Please advise what equipment we need for hot tinning angle irons about 30" long? Also what it would cost and where it can be obtained.

Inquiry 1928—We have 200,000 pieces of tin with signs painted on them to sell.

Inquiry 1929—We want to buy a plating shop or used plating and polishing equipment.

Inquiry 1930—Who makes the alloy "apperite"?

Inquiry 1931—Who carries in stock small white metal castings such as wreaths, flowers, leaves, etc., used on table plateaus?

Inquiry 1932—Who makes 32 or 34 gauge tin to be used for button backs?

Inquiry 1933—We wish to connect with manufacturers of tripoli.

Inquiry 1934—Who makes "sylphon" metal?

Inquiry 1935—Where can we obtain a large quantity of solder in the form of washers?

Inquiry 1936—Where can we buy magnalium metal in sheets?

Inquiry 1937—Where is a good place to have castings brass plated by the tumbling barrel method?

Inquiry 1938—We have about 600 iron plates we want to have polished on an automatic machine.

Inquiry 1939—I want to buy for spot cash jewelry refinings, silver nitrate and chloride.

Inquiry 1940—Who manufactures moulding and spinning machines such as are used in the manufacture of graphite crucibles?

Inquiry 1941—We are having trouble locating new or second-hand rolling mill machinery. We want rolling mills, slitters, shears, billet-molds and casting shop accessories.

Inquiry 1942—Can you tell us who makes gas producer apparatus for small outfits, especially crude oil gas generator machines.

SITUATIONS OPEN

Display Advertisements, One Column Wide, $3.00 per Inch, Each Insertion. Undisplayed, 40 Cents Per Line.

SUPERINTENDENT

WANTED—Superintendent for brass forging and finishing plant. Man with mechanical and executive ability. Some knowledge of brass foundry practice preferable but not essential. Permanent position with excellent chance for advancement. Give full particulars. Address

BRASS FORGING,
Care THE METAL INDUSTRY.

FOREMAN PLATER

WANTED—By large manufacturing concern an Assistant Foreman in Plating Department. One who is able to take charge and understands plating in all its branches. Apply, stating age, experience and wages expected. Address

ASSISTANT FOREMAN,
Care THE METAL INDUSTRY.

SALESMAN

WANTED—Salesman for foundry producing large and small work in bronze and brass. Experienced men only. Apply to

MR. HARRISON, Care REED & BARTON,
FIFTH AVE. AND 32d ST., NEW YORK CITY.

REPAIRER

WANTED — Immediately, thoroughly competent Mold Maker and Repairer for Casket Hardware factory. Apply, giving full particulars as to age, experience and salary to

REPAIRER, Care THE METAL INDUSTRY.

BRASS MOLDERS

WANTED—Three to four good tub molders and two machine molders on brass and bronze castings. Steady work and good wages.

W. A. MILLS BRASS CO.,
PORT CHESTER, NEW YORK.

SALESMAN

WANTED—A man who is thoroughly posted on prices of brass and Copper Rolling Mill products, the same knowledge covering Steel Mill products would help with sales or sales department experience in the metal line. Fine opportunity for the right man. Address

ROLLING PRODUCTS,
Care THE METAL INDUSTRY.

TRADE WANTS

AN EXCHANGE FOR THE WANTS OF THE METAL AND PLATING TRADES

ANSWERS SENT IN CARE OF THE METAL INDUSTRY WILL BE FORWARDED

SITUATIONS OPEN—Continued

BRASS FOUNDRY FOREMAN

WANTED—High Grade Foreman to handle Brass Foundry in a large corporation; man capable of developing into superintendent. Write. Address

B. H. A.,
Care THE METAL INDUSTRY.

PLATER AND FINISHER

WANTED—Experienced plater and finisher having a thorough knowledge of brass, steel, copper and nickel finishing. Position permanent with well established concern. State age, experience, and salary expected. References essential. Location New England. Address

NEW ENGLAND,
Care THE METAL INDUSTRY.

FINISHING SHOP FOREMAN

WANTED—Foreman for brass finishing shop employing about twenty men. Fine opportunity. Near New York. State age, experience, salary expected, etc. Address

S. M. CO., Care THE METAL INDUSTRY.

POLISHING FOREMAN

WANTED—Working foreman for a polishing department, employing about a dozen hands. Someone who will take interest enough in the work to get out production. Steady employment to the right party.

THE STANDARD METALWORK COMPANY,
Thompsonville, Conn.

METALLURGIST

WANTED—Practical shop metallurgist, preferably with some experience in electric furnace operation in connection with steel castings and melting ferrous alloys. Address SHOP METALLURGIST, care The Metal Industry.

SITUATIONS WANTED

Undisplayed Advertisements Under this Heading, 50 Cents Each Insertion. Displayed Advertisements, One Column Wide, $1.50 Per Inch, Each Insertion. Ads Under this Heading are payable in advance.

SALESMEN

SALESMAN

SITUATION WANTED—Practical polisher and plater desires position with supply-house as salesman. Willing to start on moderate terms. Address

SUPPLIES,
Care THE METAL INDUSTRY.

SITUATION WANTED—An experienced and successful salesman, who has had extensive training in the jobbing brass foundry business, would consider a change to a responsible concern, as an executive or representative. Capable of taking charge and insuring results. Address SUCCESSFUL, care THE METAL INDUSTRY.

COPPER REFINER

SITUATION WANTED—By a copper refiner of eight years' experience on reverberatory furnace work. Address COPPER REFINER, care THE METAL INDUSTRY.

FOUNDRYMEN

BRASS FOUNDRY EXPERT

SITUATION WANTED—Brass Foundry Expert wishes to correspond with Brass Casting Manufacturers who are in need of the service of a man that can eliminate excessive losses in Brass Foundry practice. Supreme knowledge of the operation of modern methods. Can work out difficulties and increase production in a minimum amount of time, without overworking men. Strict attention will be given correspondence. Address FOUNDRY EXPERT, Care of THE METAL INDUSTRY.

SITUATION WANTED—Efficient brass foundry superintendent or foreman of modern methods is open for a position. Familiar with modern equipment, good executive and reliable. Could accept a permanent position at an early date if inducements are satisfactory. Excellent reference as to character and ability. Full details by request. Address REQUEST, care of THE METAL INDUSTRY.

SITUATION WANTED—As General Foreman or Superintendent of brass foundry by practical and energetic man 46 years old. Temperate and a reputation for executive ability and expert knowledge of metals and alloys. Experienced in melting and mixing all kinds of alloys using oil as fuel; either crucible or open flame (Schwartz or Rockwell) furnaces. Can furnish best of references as to above qualifications. Employed at present. Address ENERGETIC, care THE METAL INDUSTRY.

SITUATION WANTED—As Superintendent or Foreman of a casting shop or foundry. Twenty years experience in mixing and melting metals. Can act as assistant to rolling mill superintendent or inspector of munitions. Address METAL, care THE METAL INDUSTRY.

SITUATION WANTED—As Brass and Bronze Foundry Foreman. Thoroughly practical and conversant in all branches. False-core work a specialty. Address CORE, care THE METAL INDUSTRY.

CHEMIST

SITUATION WANTED—Chemist, university graduate of ten years general analytical experience covering iron, steel, ferrous and non-ferrous alloys, metals of all kinds, ores, fuels, pigments, oils, rubber, water, etc., desires position of responsibility. Have had charge of laboratories. Age 34. American. Best of references. Address NON-FERROUS, care THE METAL INDUSTRY.

PLATERS AND POLISHERS

ELECTRO-PLATERS

Anyone desiring the services of first-class men for the electro-deposit on of metals and finishing in all branches and departments of the plating business can secure such services by corresponding with the Secretary of the American Electro-Platers Society.

OSCAR E. SERVIS,
5305 Warner Avenue Chicago, Ill.

SITUATION WANTED—Foreman Plater and electro-chemist who has been engaged in the plating business for the past twenty-two years, fifteen of which I have held foreman positions. Am thoroughly familiar with every branch of the business. Am a graduate of two technical schools in chemistry and one in electrical engineering. Would like to connect with a reliable firm where finishes must meet specifications and uniform results. Address W. V., care THE METAL INDUSTRY.

SITUATION WANTED—An electro-plater of 21 years' experience in electro-deposition, coloring and finishing of all classes of metals is open for engagement. Am capable of taking charge of a plating, polishing and finishing department. Can give best references from last three employers as follows: Oxweld Acetylene Co., Waverly, N. J.; Newark Plating Co., 38 Walnut Street, Newark, N. J., and the Electro-Bleaching Gas Co., 41 East 41st Street, New York, and can give further references if required. Address EDGAR PANNERT, 1859 Mayflower Avenue, Westchester, N. Y.

SITUATION WANTED—Foreman Plater desires to make a change and would like to connect with reliable firm where the services of a competent man are indispensable. Not afraid of wages, work or location. Expert on all solutions and capable of maintaining normal conditions economically. Familiar with all popular and special finishes, all modern methods in connection with polishing, lacquering and barrel plating. Capable of installing plants. Can furnish A-1 references. Address, INDISPENSABLE, care THE METAL INDUSTRY.

SITUATION WANTED—FOREMAN PLATER, of broad experience, specializing in Nickel, Brass and Copper, desires position where up-to-date methods, executive ability and maximum production from solutions consistent with highest quality of deposits are requisites. Address ANALYSIS, care THE METAL INDUSTRY.

SITUATION WANTED—As Plater in the Middle West. I have 12 years' experience in the various branches, and wish to better my position with a growing concern. I am married and can furnish references. Address J. M. G., care THE METAL INDUSTRY.

SITUATION WANTED—By a Foreman polisher and plater. One who is up-to-date and can handle help to the best advantage. Can furnish excellent references. Address QUALIFIED, care of THE METAL INDUSTRY.

BUYERS' GUIDE: ADVERTISERS' PRODUCTS

Abrasives.
Alden Speare's Sons Co., Cambridge, Mass.
Bennett-O'Connell Co., Chicago, Ill.
Burns, E. Reed, Supply Co., Brooklyn, N. Y.
Crown Rheostat & Supply Co., Chicago, Ill.
Handy & Harman, New York.
Hanson & Van Winkle Co., Newark, N. J.
Jackson Mills Emery Co., Odenweldertown, Easton, Pa.
Munning-Loeb Co., Matawan, N. J.
Rhodes, Jas. H., Co., Chicago, Ill.

Accumulators, Hydraulic.
Mesta Machine Co., Pittsburgh, Pa.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Acids (See platers' Supplies).

Acid-Proof Stoneware.
Burns, E. Reed, Supply Co., Brooklyn, N. Y.
General Ceramics Co., New York.

Air Brushes, Filters and Accessories.
De Vilbiss Mfg. Co., Toledo, O.
Eclipse Air Brush Co., Newark, N. J.
Economy Mfg. Co., Chicago, Ill.
Eureka Pneumatic Spray Co., Inc., New York.
Holton, B. E., Co., Los Angeles, Cal.
Vapor Valve Co., St. Louis, Mo.

Air Compressors.
De Vilbiss Mfg. Co., Toledo, O.
Eclipse Air Brush Co., Newark, N. J.
Eureka Pneumatic Spray Co., Inc., New York.
General Electric Co., Schenectady, N. Y.
Leiman Bros., New York.
Mesta Machine Co., Pittsburgh, Pa.
New Haven Sand Blast Co., New Haven, Conn.
Pangborn Corporation, Hagerstown, Md.
Taylor Instrument Companies, Rochester, N. Y.
Vapor Valve Co., St. Louis, Mo.

Alloys (Carbon Free).
Goldschmidt Thermit Co., New York.

Alloys Made to Specifications.
Ajax Metal Co., Philadelphia, Pa.
Birkenstein S., & Sons, Chicago, Ill.
Columbia Smelting & Refining Works, New York.
Coates, Bennett Reidenbach, Inc., Rochester, N. Y.
Damascus Bronze Co., Pittsburgh, Pa.
Electric Smelting & Alum'n Co., Lockport, N. Y.
Goldschmidt Thermit Co., New York.
Lang, R. F., New York.
Leavitt, C. W., & Co., New York.
Lowenthal Co., The, Chicago, Ill.
Michigan Smelting & Refining Co., Detroit, Mich.
Ney, The J. M., Company, Hartford, Conn.
North American Smelting Co., Philadelphia, Pa.
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Rumford Metal Co., New York.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Syracuse Smelting Works, Brooklyn, N. Y.
Union Smelting & Refining Co., Inc., New York.

Aluminum Alloys.
Ajax Metal Co., Philadelphia, Pa.
American Boron Products Co., Reading, Pa.
Aluminum Co. of America, Pittsburgh, Pa.
Birkenstein, S., & Sons, Chicago, Ill.
British Aluminum Co., Ltd., New York and Toronto.
Electric Smelting & Alum'n Co., Lockport, N. Y.
General Smelting Corp., New York.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Seligman, Arthur, New York.
Syracuse Smelting Works, Brooklyn, N. Y.
United Smelt. & Alum'n Co., New Haven, Conn.
Wenger & Co., Paul, New York.

Aluminum Bronze Ingots.
Electric Smelting & Alum'n Co., Lockport, N. Y.

Aluminum Castings.
Aluminum Company of America, Pittsburgh, Pa.
Cleveland (Ohio) Metal Products Co., Ivanhoe Plant.
Light Mfg. & Foundry Co., Pottstown, Pa.
North American Smelting Co., Philadelphia, Pa.
Weil, Louis, New York.

Aluminum Die Castings.
Acme Die Casting Corporation, Brooklyn, N. Y.
Doehler Die-Casting Co., Brooklyn, N. Y.
Light Mfg. & Foundry Co., Pottstown, Pa.
Precision Castings Co., Inc., Syracuse, N. Y.
Stewart Mfg. Co., Chicago, Ill.

Aluminum Electrical Conductors.
Aluminum Company of America, Pittsburgh, Pa.
British Aluminum Co., Ltd., New York and Toronto.

Aluminum Flux.
Allen, L. B. Co., Inc., Chicago, Ill.
Paxson, J. W., Co., Philadelphia, Pa.

Aluminum Granulated.
Seligman, Arthur, New York.
Syracuse Smelting Works, Brooklyn, N. Y.
United Smelt. & Aluminum Co., New Haven, Conn.
Wenger & Co., Paul, New York.

Aluminum Ingots.
Ajax Metal Co., Philadelphia, Pa.
Aluminum Company of America, Pittsburgh, Pa.
Birkenstein, S., & Sons, Chicago, Ill.
British Aluminum Co., Ltd., New York and Toronto.
Electric Smelting & Alum'n Co., Lockport, N. Y.
General Smelting Corporation, New York.
Great Western Smtg. & Refg. Co., St. Louis, Mo.
Kemp, W. H., Co., New York.
Leavitt, C. W., & Co., New York.
Leygrand & Co., Inc., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Nassau Smtg. and Rfg. Works, New York.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Seligman, Arthur, New York.
Syracuse Smelting Works, Brooklyn, N. Y.
Trotter, Nathan, & Co., Philadelphia, Pa.
United Smelt. & Aluminum Co., New Haven, Conn.
Weil, Louis, New York.
Wenger, Paul, & Co., New York.

Aluminum Match Plates.
British Aluminum Co., Ltd., New York and Toronto.
Cleveland (Ohio) Metal Products Co., Ivanhoe Plant.
Seligman, Arthur, New York.
Turner Machine Co., Philadelphia, Pa.

Aluminum Moldings and Extruded Shapes.
Aluminum Company of America, Pittsburgh, Pa.
British Aluminum Co,, Ltd., New York and Toronto.
Seligman, Arthur, New York.
Wenger & Co., Paul, New York.

Aluminum Powder, Leaf and Foil.
Aluminum Company of America, Pittsburgh, Pa.
British Aluminum °Co., Ltd., New York and Toronto.
General Smelting Corp., New York.
Kemp, W. H., Co., New York.
Leygrand & Co., Inc., New York.
Seligman, Arthur, New York.
United Smelting & Aluminum Co., New Haven, Conn.
Wenger & Co., Paul, New York.

Aluminum Rivets.
British Aluminum Co., Ltd., New York and Toronto.
Hassall, John, Inc., Brooklyn, N. Y.
Kemp, W. H., Co., New York.
Seligman, Arthur, New York.

Aluminum Sheets, Rods, Coils and Wire.
Aluminum Company of America, Pittsburgh, Pa.
British Aluminum Co., Ltd., New York and Toronto.
Cleveland (Ohio) Metal Products Co., Ivanhoe Plant.
Electric Smelting & Alum'n Co., Lockport, N. Y.
Kemp, W. H., Co., New York.
Leygrand & Co., Inc., New York.
Richards & Co., Boston, Mass.
Seligman, Arthur, New York.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
United Smelt. & Aluminum Co., New Haven, Conn.
Wenger & Co., Paul, New York.

Aluminum Solder (See Solder).

Aluminum Tubes.
Aluminum Company of America, Pittsburgh, Pa.
British Aluminum Co., Ltd., New York and Toronto.
Kemp, W. H., Co., New York.
Seligman, Arthur, New York.
Wenger & Co., Paul, New York.

Aluminum Welding.
Cleveland (Ohio) Metal Products Co., Ivanhoe Plant.

Ammeters and Voltmeters (See Platers' Supplies).

Amyl Acetate (See Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Franco-American Chemical Co., Carlstadt, N. J.

Annealing Muffles.
Metals Production Equipment Co., New York.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Rockwell, W. S., Co., New York.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Whiting Foundry Equipment Co., Harvey, Ill.

Anodes, Brass, Copper or Nickel (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Ely, C. Upham, New York.
Hanson & Van Winkle Co., Newark, N. J.
Harshaw, Fuller & Goodwin Co., Cleveland, O.
Hussey, C. G., & Co., Pittsburgh, Pa
L'Hommedieu, Chas. F., & Sons, Chicago, Ill.
Munning-Loeb Co., Matawan, N. J.
National Galvanizing & Plating Equipment Corp., New York.
Neubeck, Adolf, Buffalo, N. Y.
New York Buff Co., New York.
Seymour Manufacturing Co., The, Seymour, Conn.
Stamford Rolling Mills, Inc., New York.
U. S. Electro-Galvanizing Co., Brooklyn, N. Y.

Anodes, Gold.
Handy & Harman, New York.
Jackson, John J., Newark, N. J.
Ney, The J. M., Company, Hartford, Conn.

Anodes, Platinum.
Handy & Harman, New York.
Ney, The J. M., Company, Hartford, Conn.
Roessler & Hasslacher Chemical Co., New York.
Stein, Wm. A., Newark, N. J.

Anodes, Silver (See also Platers' Supplies).
Handy & Harman, New York.
Jackson, John J., Newark, N. J.
Ney, The J. M., Company, Hartford, Conn.

Anodes, Zinc (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Burns, E. Reed Supply Co., Brooklyn, N. Y.
Crown Rheostat & Supply Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.
Wiarda & Co., John C., Brooklyn, N. Y.

Antimonial Lead.
Leavitt, C. W., & Co., New York.
North American Smelting Co., Philadelphia, Pa.
Seligman, Arthur, New York.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Union Smelting & Refining Co., Inc., New York.
Wenger & Co., Paul, New York.

Antimony Metal.
Ajax Metal Co., Philadelphia, Pa.
Birkenstein, S., & Sons, Chicago, Ill.
Cooper, Charles, & Co., New York.
Great Western Smtg. & Refg. Co., St. Louis, Mo.
Hendricks Bros., New York.
Herscopf & Son, Ch., Brooklyn, N. Y.
Hiertz Metal Co., Theo., St. Louis, Mo.
Leavitt, C. W., Co., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Nassau Smtg. and Rfg. Works, New York.
Richards & Co., Boston, Mass.
Seligman, Arthur, New York.
Syracuse Smelting Works, Brooklyn, N. Y.
Trotter, Nathan, & Co., Philadelphia, Pa.
Union Smelting & Refining Co., Inc., New York.
Weil, Louis, New York.
Wenger & Co., Paul, New York.
Wiarda & Co., John C., Brooklyn, N. Y.

Art Bronze Foundry.
Vatier, Ernest, New York.

Ashes Grinders and Separators.
Paxson, J. W., Co., Philadelphia, Pa.

Assayers and Chemists.
Handy & Harman, New York.
Ledoux & Co., New York.
Ricketts & Co., New York.

Automatic Buffing and Polishing Machines.
Automatic Buffing Machine Co., Buffalo, N. Y.

Automatic Wire and Metal Working Machinery.
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Shuster, F. B., Co., New Haven, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Automobile Wire Spoke Headers.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Babbitt Metals.
Argus Smelting Co., New York.
Ajax Metal Co., Philadelphia, Pa.
American Boron Products Co., Reading, Pa.
Benson, H. K. & F. S., Glen Ridge, N. J.
Birkenstein, S., & Sons, Chicago, Ill.
Columbia Smelting & Refining Works, New York.
Damascus Bronze Co., Pittsburgh, Pa.
Electric Smelt. & Aluminum Co., Lockport, N. Y.
Great Western Smtg. & Refg. Co., St. Louis, Mo.
Hiertz Metal Co., Theo., St. Louis, Mo.
Michigan Smelting & Refining Co., Detroit, Mich.
Nassau Smtg. and Rfg. Works, New York.
New Era Mfg. Co., Kalamazoo, Mich.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Syracuse Smelting Works, Brooklyn, N. Y.
Union Smelting & Refining Co., New York.
White & Bro., Philadelphia, Pa.

Babbitt Molds.
Paxson, J. W., Co., Philadelphia, Pa.
Schweizer, Chas. K., Co., St. Louis, Mo.

Bakelite.
General Bakelite Co., New York.

Baking Ovens.
Gehnrich Indirect Heat Oven Co., Brooklyn, N. Y.
General Electric Co., Schenectady, N. Y.
Monarch Engineering & Mfg. Co., Baltimore, Md.

Baling Presses (See Cabbaging Presses).

Balls, Steel, for Burnishing.
Abbott Ball Co., Hartford, Conn.
Baird Machine Co., Bridgeport, Conn.
Globe Machine & Stamping Co., Cleveland, O.
Smith, Richardson Co., Attleboro, Mass.

Belts, Polishing.
Ames Sword Co., Chicopee, Mass.

Block Tin (See Tin).

Block Tin Pipe.
North American Smelting Co., Philadelphia, Pa.
Standard Rolling Mills Inc., Brooklyn, N. Y.
Union Smelting & Refining Co., Inc., New York.

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Blowers and Blow Piping.
Allington & Curtis Mfg. Co., Chicago, Ill.
Astle, H. J., & Co., Providence, R. I.
Cleveland Blow Pipe & Mfg. Co., Cleveland, O.
Kirk & Blum Co., Cincinnati, O.
Leiman Bros., New York.
Monarch Engineering & Mfg. Co., Baltimore, Md.
New Haven Sand Blast Co., New Haven, Conn.

Blow Torches, Gas.
Allen, L. B., Co., Inc., Chicago.

Bolt Heading, Trimming and Threading Machines.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Boiler Graphite.
Dixon, Jos., Crucible Co., Jersey City, N. J.
Obermayer, The S., Co., Pittsburgh, Pa.

Boron and Boron Copper Products.
American Boron Products Co., Reading, Pa.
General Electric Co., Schenectady, N. Y.

Boron Flux.
American Boron Products Co., Reading, Pa.
General Electric Co., Schenectady, N. Y.

Branding Tools, Gas.
Allen, L. B., Co., Inc., Chicago, Ill.

Brass Briquet-Ingots.
Eastern Brass & Ingot Corp., Waterbury, Conn.

Brass and Bronze Architectural Work.
Manhattan Brass Co., New York.

Brass, Bronze and Composition Ingots and Castings.
Argus Smelting Co., New York.
Ajax Metal Co., Philadelphia, Pa.
American Brass Co., Waterbury, Conn.
Birkenstein, S., & Sons, Chicago, Ill.
Coates, Bennett & Reidenbach, Inc., Rochester, N. Y.
Damascus Bronze Co., Pittsburgh, Pa.
Great Western Smt. & Refg. Co., St. Louis, Mo.
Hegt, Herman J., New York.
Herscopf & Son, Ch., Brooklyn, N. Y.
Lehman Bros., Hoboken, N. J.
Lowenthal Co., The, Chicago, Ill.
Michigan Smelting & Refining Co., Detroit, Mich.
Nassau Smtg. and Rfg. Co., Works, New York.
North American Smelting Co., Philadelphia, Pa.
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Seligman, Arthur, New York.
Syracuse Smelting Works, Brooklyn, N. Y.
Taunton-New Bedford Copper Co., New Bedford, Mass.
Whipple & Choate, Bridgeport, Conn.
White & Bro., Inc., Philadelphia, Pa.

Brass, Bronze, Copper or Oreide Sheet, Wire, Rod, Tubes, Etc.
American Brass Co., The, Waterbury, Conn.
Benson, H. K. & F. S., Glen Ridge, N. J.
Bridgeport Brass Co., Bridgeport, Conn.
Bristol Brass Co., Bristol, Conn.
Brown's Copper & Brass Rolling Mills, Ltd., New Toronto, Canada.
Connecticut Brass Corporation, West Cheshire, Conn.
Continuous Casting Corporation, New York.
Dallas, A. C., & Son, Inc., Chicago, Ill.
Damascus Bronze Co., Pittsburgh, Pa.
Dueber Watch Case Mfg. Co., Canton, O.
Gardner Co., The B. M., Cleveland, O.
Gem Mfg. Co., N. S., Pittsburgh, Pa.
Hegt, Herman J., New York.
Hendricks Bros., New York.
Hussey, C. G., & Co., Pittsburgh, Pa.
Leavitt, C. W., & Co., New York.
Manhattan Brass Co., New York.
Metal Export Co., New York.
Metals Trading Corporation, New York.
Mohegan Tube Co., Brooklyn, N. Y.
National Brass & Copper Co., Lisbon, O.
National, The, Co., Waterbury, Conn.
New Jersey Tube Co., Harrison, N. J.
Pilling Brass Co., Waterbury, Conn.
Philadelphia Brass Co., Philadelphia, Pa.
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Rome Hollow Wire & Tube Co., Rome, N. Y.
Rome Wire Co., Rome, N. Y.
Scovill Manufacturing Co., Waterbury, Conn.
Seymour Manufacturing Co., The, Seymour, Conn.
Stamford Rolling Mills, Inc., New York.
Taunton-New Bedford Copper Co., New Bedford, Mass.
Trumpbour-Whitehead Co., New York.
Weil, Louis, New York.
Wells, A. H., Co., Waterbury, Conn.
Winchester, B. & C. Co., West Winsted, Conn.

Brass and Bronze Founders.
Ajax Metal Co., Philadelphia, Pa.
Mesta Machine Co., Pittsburgh, Pa.
North American Smelting Co., Philadelphia, Pa.

Brass Discs, Cups, Etc.
Bristol Brass Co., Bristol, Conn.
Brown's Copper & Brass Rolling Mills, Ltd., New Toronto, Canada.
Connecticut Brass Corporation, West Cheshire, Conn.
Metals Trading Corporation, New York.
Stamford Rolling Mills, Inc., New York.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Stimpson, Edwin B., Co., Brooklyn, N. Y.

Brass Forgings.
American Brass Products Co., Pottstown, Pa.
Continuous Casting Corporation, New York.
Metals Trading Corporation, New York.
Sholes Standard Typewriter Co., Garfield, N. J.

Brass Foundries.
American Brass Products Co., Pottstown, Pa.

Brass Foundry Equipment (See Foundry Supplies and Equipment).

Brass Mill Machinery.
Continuous Casting Corporation, New York.
Garrison, A., Fdy. & Machine Co., Pittsburgh, Pa.
Torrington Mfg. Co., Torrington, Conn.
Waterbury (Conn.) Farrel Fdy. & Machine Co.

Brazing Paste.
Allen, L. B., Co., Inc., Chicago, Ill.

Brazing Wire.
American Brass Co., Waterbury Brass Branch, Waterbury, Conn.

Brinell Hardness Testing Instruments.
Holz, Herman A., New York.

Briquet-Ingots.
Eastern Brass & Ingot Corp., Waterbury, Conn.
General Briquetting Co., New York.

Briquetting Machines.
Eastern Brass & Ingot Corp., Waterbury, Conn.
General Briquetting Co., New York.

Britannia Metal.
Benson, H. K. & F. S., Glen Ridge, N. J.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Syracuse Smelting Works, Brooklyn, N. Y.
Union Smelting & Refining Co., New York.

Bronze Powder.
Dupont Chemical Co., New York.

Bronze Sheets, Wire Rods, Etc. (See Brass, Bronze and Copper Sheets, Etc).

Bronze, Statuary, Etc.
Vatier, Ernest, New York.

Bronze Tubes (See Brass, Bronze and Copper Tubes).

Brushes, Wire and Bristle (See also Foundry Supplies and Platers' Supplies).
Blumenthal, H., & Co., New York.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Crown Rheostat & Supply Co., Chicago, Ill.
Gem Mfg. Co., N. S., Pittsburgh, Pa.
Hanson & Van Winkle Co., Newark, N. J.
Manufacturers' Brush Co., Cleveland, O.
Munning-Loeb Co., Matawan, N. J.
New York Buff Co., New York.
Obermayer, The S., Co., Pittsburgh, Pa.
Paxson, J. W., Co., Philadelphia, Pa.

Buffing and Polishing Supplies and Equipment (See Platers', Polishers' and Galvanizers' Supplies).

Buffs (See Platers' and Polishers' Supplies).

Bull-Dozers.
Wood, R. D., & Co., Philadelphia, Pa.

Burners, Enclosed Flame Gas.
Gehnrich Indirect Heat Oven Co., Brooklyn, N. Y.

Burners, Fuel Oil or Gas (See also Foundry Supplies).
Hawley Down Draft Furnace Co., Easton, Pa.
Metals Production Equipment Co., New York.
Monarch Eng. & Mfg. Co., Baltimore, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Rockwell, W. S., & Co., New York.

Burners, Powdered Coal.
Metals Production Equipment Co., New York.

Burnishing Barrels (See also Platers' Supplies).
Abbott Ball Co., Hartford, Conn.
Baird Machine Co., Bridgeport, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Parsons Mfg. Co., The, Chicago, Ill.
Smith, Richardson, Co., Attleboro, Mass.
Tolhurst Machine Works, Troy, N. Y.

Burnishing Barrels, Leather Metal for.
Hanson & Van Winkle Co., Newark, N. J.

Burnishing Compounds and Chips (See also Platers' and Polishers' Supplies).
International Chemical Co., Camden, N. J.

Cabbaging Presses.
General Briquetting Co., New York.
Paxson, J. W., Co., Philadelphia, Pa.
Wood, R. D., & Co., Philadelphia, Pa.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.

Calcium-Copper Alloys.
American Magnesium Corp., Niagara Falls, N. Y.

Carboy Rockers.
Munning-Loeb Co., Matawan, N. J.

Case Hardening Materials.
Buchanan, C. G., Chemical Co., Cincinnati, O.
Paxson, J. W., Co., Philadelphia, Pa.

Castings (See name of metal wanted).

Castings, Iron Machinery.
Bliss Co., E. W., Brooklyn, N. Y.
Mesta Machine Co., Pittsburgh, Pa.
Metals Production Equipment Co., New York.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Wood, R. D., & Co., Philadelphia, Pa.

Caustic Potash (See Platers', Polishers' and Galvanizers' Supplies).

Cement, Furnace.
Dixon, Jos., Crucible Co., Jersey City, N. J.
Quigley Furnace Specialties Co., Inc., New York.

Centrifugal Dryers and Extractors.
Hanson & Van Winkle Co., Newark, N. J.
No-Dust Drying Machine Co., Providence, R. I.
Tolhurst Machine Works, Troy, N. Y.

Charcoal, Crude and Powdered (See also Foundry Supplies).
Paxson, J. W., Co., Philadelphia, Pa.

Chasing and Modeling.
Fogg, Arthur A., Meriden, Conn.
Vatier, Ernest, New York.

Chemicals (See Platers' Supplies).

Chemists and Analysts.
Harris Laboratory, Inc., New York.
Ledoux & Co., New York.
Ricketts & Co., New York.

Chromium (Pure) and Chromium Cupro.
Goldschmidt Thermit Co., New York.

Chucks, Spinning.
Bliss, E. W., Co., Brooklyn, N. Y.
Pryibil, P., Machine Co., Inc., N. Y.

Cinder Mills, Water (See Crushers, Cinder).

Cleaning Compounds for Metals (See also Platers' Supplies).
Anthony, H. M., & Co., New York.
Bennett-O'Connell Co., Chicago, Ill.
Buchanan, C. G., Chemical Co., Cincinnati, O.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Crown Rheostat & Supply Co., Chicago, Ill.
Electric Smelt. & Aluminum Co., Lockport, N. Y.
Ford, J. B., Co., Wyandotte, Mich.
Hanson & Van Winkle Co., Newark, N. J.
International Chemical Co., Camden, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Munning-Loeb Co., Matawan, N. J.
New York Buff Co., New York.
Oakley Chemical Co., New York.
Rhodes, James H., & Co., Chicago, Ill.
Solvay Process Co., Syracuse, N. Y.
Wiarda & Co., John C., Brooklyn, N. Y.

Cock Grinders, Automatic.
Turner Machine Co., Philadelphia, Pa.

Coiling Machines (See also Rolling Mill Machinery).
Baird Machine Co., Bridgeport, Conn.
Torrington Manufacturing Co., Torrington, Conn.

Compositions, Buffing (See Platers', Polishers' and Galvanizers' Supplies).

Compressors, Centrifugal, Air and Gas.
General Electric Co., Schenectady, N. Y.

Concentrating Tables.
Hardinge Conical Mill Co., New York.
Mine & Smelting Supply Co., New York.

Consulting Platers (See Expert Instruction).

Copper Castings.
Ajax Metal Co., Philadelphia, Pa.
Weil, Louis, New York.

Copper-clad Sheet, Wire, Etc.

Copper Cyanide.
Apothecaries Hall Co., Waterbury, Conn.
Roessler & Hasslacher Chemical Co., New York.
Wiarda, John C., & Co., Brooklyn, N. Y.

Copper, Electrolytic.
United Metals Selling Co., New York.
United States Smelting Co., Inc., New York.
Wenger & Co., Paul, New York.

Copper Ingots.
Ajax Metal Co., Philadelphia, Pa.
Balbach Smelting & Refining Co., Newark, N. J.
Birkenstein, S., & Sons, Chicago, Ill.
Hendricks Bros., New York.
Leavitt, C. W., & Co., New York.
Metals Trading Corporation, New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Nassau Smtg. and Refg. Works, New York.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Seligman, Arthur, New York.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Syracuse Smelting Works, Brooklyn, N. Y.
Taunton-New Bedford Copper Co., New Bedford, Mass.
Trotter, Nathan, & Co., Philadelphia, Pa.
United Metals Selling Co., New York.
Wenger & Co., Paul, New York.
White & Bro., Inc., Philadelphia, Pa.

Copper and Composition Nails, Tacks and Rivets.
Hassell, John, Inc., New York.
Hussey, C. G., & Co., Pittsburgh, Pa.
Scovill Manufacturing Co., Waterbury, Conn.
Taunton-New Bedford Copper Co., New Bedford, Mass.

Copper Sheet, Wire, Rods, Bolts, Etc. (See Brass, Bronze and Copper Sheets, Etc).

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Copper Shot.
Handy & Harman, New York.
Seymour Manufacturing Co., Seymour, Conn.

Copper Tubes (See Brass and Copper Tubes).

Core Compound (See also Foundry Supplies).
Dixon, Jos., Crucible Co., Jersey City, N. J.
Obermayer, The S., Co., Pittsburgh, Pa.
Paxson, J. W., Co., Philadelphia, Pa.

Core Machines (See Foundry Supplies).
Brown Specialty Machinery Co., Chicago, Ill.
Obermayer, The S., Co., Pittsburgh, Pa.
Paxson, J. W., Co., Philadelphia, Pa.
Wadsworth Core Machine & Equip. Co., Akron, O.

Core Oil.
Paxson, J. W., Co., Philadelphia, Pa.

Core Ovens (See also Foundry Supplies).
Gehnrich Indirect Heat Oven Co., Brooklyn, N. Y.
Metals Production Equipment Co., New York.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer, The S., Co., Pittsburgh, Pa.
Paxson, J. W., Co., Philadelphia, Pa.
Steiner, E. E., Newark, N. J.
Wadsworth Core Machine & Equip. Co., Akron, O.
Whiting Foundry Equipment Co., Harvey, Ill.

Core Tapering Machines.
Brown Specialty Machinery Co., Chicago, Ill.

Core Trays Steel.
Paxson, J. W., Co., Philadelphia, Pa.
Wadsworth Core Machine & Equip. Co., Akron, O.

Countershafts, Ball Bearing.
Gardner Machine Co., Beloit, Wis.

Cranes.
N. J. Foundry & Machine Co., New York.
Whiting Foundry Equipment Co., Harvey, Ill.

Crucibles, Stirrers, Stoppers, Nozzles, Etc. (See also Foundry Supplies).
Bartley, Jonathan, Crucible Co., Trenton, N. J.
Crucible Co. of New Jersey, Perth Amboy, N. J.
Dixon, Jos., Crucible Co., Jersey City, N. J.
Foreign Crucible Corporation, Ltd., New York.
Gautier, J. H., & Co., Jersey City, N. J.
General Platers' Supply Co., New York.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
New Chicago Crucible Co., Chicago, Ill.
Obermayer, The S., Co., Pittsburgh, Pa.
Paxson, J. W., Co., Philadelphia, Pa.
Seidel, R. B., Inc., Philadelphia, Pa.
Taylor, R. J., Inc., Philadelphia, Pa.
Vesuvius Crucible Co., Swissvale, Pa.

Crushers, Cinder (See also Foundry Supplies).
Eastern Machinery Co., New Haven, Conn.
Hardinge Conical Mill Co., New York.
Mine & Smelter Supply Co., New York.
Moussette Co., O. J., Inc., Brooklyn, N. Y.
Obermayer, The S., Co., Pittsburgh, Pa.
Paxson, J. W., Co., Philadelphia, Pa.
Standard Equipment Co., New Haven, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Whiting Foundry Equipment Co., Harvey, Ill.

Cube Nickel.
Burns, E. Reed, Supply Co., Brooklyn, N. Y.
Wiarda, John C., & Co., Brooklyn, N. Y.

Cupels.
Dixon, Jos., Crucible Co., Jersey City, N. J.

Cupolas.
Obermayer, The S., Co., Pittsburgh, Pa.
Paxson, J. W., Co., Philadelphia, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Cupro-Nickel.
Stamford Rolling Mills, Inc., New York.

Cyanide of Potassium (See Platers' Supplies).

Cyanide of Sodium (See Platers' Supplies).

Dental Golds and Solders.
Ney, The J. M., Co., Hartford, Conn.

Deoxidizers for Metals.
American Boron Products Co., Reading, Pa.
General Electric Co., Schenectady, N. Y.
Obermayer, The S., Co., Pittsburgh, Pa.
Rumford Metal Co., New York.

Die-Casting Machinery.
Acme Die Casting Corp., Brooklyn, N. Y.
Doehler Die Casting Co., Brooklyn, N. Y.

Die Castings, Brass and Bronze.
Doehler Die Casting Co., Brooklyn, N. Y.
Stewart Mfg. Co., Chicago, Ill.

Die Castings, White Metal, Aluminum, Etc.
Acme Die Casting Corp., Brooklyn, N. Y.
Doehler Die Casting Co., Brooklyn, N. Y.
Light Mfg. & Foundry Co., Pottstown, Pa.
Precision Castings Co., Inc., Syracuse, N. Y.
Stewart Mfg. Co., Chicago, Ill.

Dies, Sheet Metal Working.
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Cleveland (Ohio) Metal Products Co., Ivanhoe, Plant.
Gem Mfg. Co., N. S., Pittsburgh, Pa.
Globe Machine & Stamping Co., Cleveland, O.
Sholes Standard Typewriter Co., Garfield, N. J.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Dipping Baskets, Wire.
Driver-Harris Co., Newark, N. J.
New York Buff Co., New York.
Paxson, J. W., Co., Philadelphia, Pa.
Smith, John P., & Co., New Haven, Conn.

Dipping Baskets, Stoneware.
Burns, E. Reed, Supply Co., Brooklyn, N. Y.
General Ceramics Co., New York.
New York Buff Co., New York.

Disc Polishing and Grinding Machines.
Gardner Machine Co., Beloit, Wis.

Dowel Pins (See also Foundry Supplies).
Paxson, J. W., Co., Philadelphia, Pa.

Draw Benches, Wire, Rod and Tube.
Continuous Casting Corporation, New York.
Leiman Bros., New York.
Torrington Mfg. Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Drosses (See Metal Turnings, Drosses, Etc.).

Drop Hammers.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Drying-Out Machines.
Astle, H. J., & Co., Providence, R. I.
Baird Machine Co., Bridgeport, Conn.
No-Dust Drying Machine Co., Providence, R. I.
Smith, Richardson Co., Attleboro, Mass.
Tolhurst Machine Works, Troy, N. Y.
Torrington Mfg. Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Drying Ovens.
Gehnrich Indirect Heat Oven Co., Brooklyn, N. Y.
General Electric Co., Schenectady, N. Y.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Paxson, J. W., Co., Philadelphia, Pa.

Dust Arresters.
Brown Specialty Machinery Co., Chicago, Ill.
Paxson, J. W., Co., Philadelphia, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Dust Collectors and Ventilating Systems.
Allington & Curtis Mfg. Co., Chicago, Ill.
Astle, H. J., & Co., Providence, R. I.
Cleveland Blow Pipe & Mfg. Co., Cleveland, O.
Kirk & Blum Co., Cincinnati, O.
Leiman Bros., New York.
Pangborn Corporation, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.

Dynamos, Platers' and Galvanizers' (See also Platers' Supplies).
Bennett-O'Connell Co., Chicago, Ill.
Bogue, Chas. J., Electric Co., New York.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Crown Rheostat & Supply Co., Chicago, Ill.
Eager Electric Co., Watertown, N. Y.
General Electric Co., Schenectady, N. Y.
Hanson & Van Winkle Co., Newark, N. J.
Jantz & Leist Co., Cincinnati, O.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Munning-Loeb Co., Matawan, N. J.
National Galvanizing & Plating Equipment Corporation, New York.
New York Buff Co., New York.

Electric Cleaning Compounds (See Cleaning Compounds, Metal).

Electric Melting Furnaces.
Electric Furnace Co., Alliance, O.

Electrogalvanizing Equipment (See Galvanizing Equipment).

Electroplating Equipment (See Platers', Polishers' and Galvanizing Equipment and Supplies).

Electroplating, Polishing, Coloring, Etc.
Bronze Products Society, Brooklyn, N. Y.
Hassall, John, Inc., Brooklyn, N. Y.
Mohegan Tube Co., Brooklyn, N. Y.
Sievering, Philip, New York.
Terrace Electric Plating Co., New York.

Elevators.
Obermayer, The S., Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Emery.
Alden Speare's Sons Co., Cambridge, Mass.
Jackson Mills Emery Co., Odenweldertown, Easton, Pa.
Rhodes, Jas. H., & Co., Chicago, Ill.

Emery Wheel Dressing Machine.
Divine Brothers Co., Utica, N. Y.

Enameling and Japanning Ovens.
Gehnrich Indirect Heat Oven Co., Brooklyn, N. Y.
General Electric Co., Schenectady, N. Y.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Steiner, E. E., Newark, N. J.

Enameling, Porcelain.
Cleveland (Ohio) Metal Products Co., Ivanhoe Plant.

Engineers, Foundry.
Paxson, J. W., Co., Philadelphia, Pa.
Quigley Furnace Specialties Co., Inc., New York.
Whiting Foundry Equipment, Harvey, Ill.

Engineers, Furnace.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Quigley Furnace Specialties Co., Inc., New York.
Rockwell, W. S., Co., New York.

Engines, Rolling Mill, Hoisting, Etc.
Mesta Machine Co., Pittsburgh, Pa.

Escutcheon Pins, All Metals.
Hassall, John, Brooklyn, N. Y.

Ethyl Acetate.
Franco-American Chemical Co., Carlstadt, N. J.

Eyelet Machinery.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Exhaust Fans and Heads (See also Dust Collectors), Etc.
Allington & Curtis Mfg. Co., Chicago, Ill.
Cleveland Blow Pipe & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Kirk & Blum Co., Cincinnati, O.
Leiman Bros., New York.
Pangborn Corporation, Hagerstown, Md.

Exhaust Fans, Stoneware.
General Ceramics Co., New York.

Extractors, Centrifugal, Drying.
Tolhurst Machine Works, Troy, N. Y.

Felt Polishing Wheels.
Divine Bros. Co., Utica, N. Y.
Rhodes & Co., Jas. H., Chicago, Ill.

Felt Sheets.
House & Sons, Chas. W., Unionville, Conn.
Rhodes & Co., Jas. H., Chicago, Ill.

Ferro Case.
Buchanan, C. G., Chemical Co., Cincinnati, O.

Fig Cleanser.
Burns, E. R., Supply Co., Brooklyn, N. Y.
International Chemical Co., Camden, N. Y.

Fillets, Leather (See Foundry Supplies and Equipment).

Fire Brick and Cement (See also Foundry Supplies).
Paxson, J. W., Co., Philadelphia, Pa.
Quigley Furnace Specialties Co., Inc., New York.

Flasks, Brass Molders' (See also Foundry Supplies).
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer, The S., Co., Pittsburgh, Pa.
Paxson, J. W., Co., Philadelphia, Pa.
Woodison, E. J., Co., Detroit, Mich.

Flint Shot.
U. S. Silica Co., Chicago, Ill.

Floor Plates (See also Foundry Supplies).
Paxson, J. W., Co., Philadelphia, Pa.

Fluor Spar (See also Foundry Supplies).
Paxson, J. W., Co., Philadelphia, Pa.

Fluxes for Metals.
American Boron Products Co., Reading, Pa.
General Electric Co., Schenectady, N. Y.
New Era Mfg. Co., Kalamazoo, Mich.
Obermayer, The S., Co., Pittsburgh, Pa.
Paxson, J. W., Co., Philadelphia, Pa.
Rumford Metal Co., New York.

Fluxes, Soldering and Tinning.
Allen, L. B., Co., Inc., Chicago, Ill.
Buchanan, C. G., Chemical Co., Cincinnati, O.
Richards & Co., Boston, Mass.

Forgings, Brass.
American Brass Products Co., Pottstown, Pa.
Sholes Standard Typewriter Co., Garfield, N. J.

Forgings, Drop.
Bliss, E. W., Co., Brooklyn, N. Y.
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Foundry Facings (See Foundry Supplies).

Foundry Pails.
Obermayer, The S., Co., Pittsburgh, Pa.
Paxson, J. W., Co., Philadelphia, Pa.

Foundry Riddles (See Foundry Supplies and Equipment).

Foundry Supplies and Equipment (See also Foundry Facings, Furnaces, Etc).
Bartley, Jonathan, Crucible Co., Trenton, N. J.
Birkenstein, S., & Sons, Chicago, Ill.
Blumenthal, H., & Co., New York
Brown Specialty Machinery Co., Chicago, Ill.
Crucible Co., of New Jersey, Perth Amboy, N. J.
Dings Magnetic Separator Co., Milwaukee, Wis.
Dixon, Jos., Crucible Co., Jersey City, N. J.
Eastern Machinery Co., New Haven, Conn.
Gem Mfg. Co., N. S., Pittsburgh, Pa.
Gautier, J. H., & Co., Jersey City, N. J.
Gehnrich Indirect Heat Oven Co., Brooklyn, N. Y.
Hardinge Conical Mill Co., New York.
Hawley Down Draft Furnace Co., Easton, Pa.
Ideal Furnace Co., Chester, Pa.
Magnetic Manufacturing Co., Milwaukee, Wis.
Malleable Iron Fittings Co., Branford, Conn.
Manufacturers' Brush Co., Cleveland, O.
McCullough-Dalzell Crucible Co., Pittsburgh, Pa.
Mine & Smelter Supply Co., New York.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Moussette Co., O. J., Inc., Brooklyn, N. Y.
N. J. Foundry & Machine Co., New York.
Obermayer, The S., Co., Pittsburgh, Pa.
Pangborn Corporation, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Quigley Furnace Specialties Co., Inc., New York.
Rockwell, W. S., Co., New York.
Seidel, R. B., Inc., Philadelphia, Pa.
Standard Equipment Co., New Haven, Conn.
Steiner, E. E., Newark, N. J.
Taylor, R. J., Inc., Philadelphia, Pa.
Turner Machine Co., Philadelphia, Pa.

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U. S. Silica Co., Chicago, Ill.
Vesuvius Crucible Co., Swissvale, Pa.
Wadsworth Core Machine & Equip. Co., Akron, O.
Whiting Foundry Equipment Co., Harvey, Ill.
Woodison, E. J., Co., Detroit, Mich.

Furnace Insulation.
Armstrong Cork & Insulation Co., Pittsburgh, Pa.

Furnace Specialties.
Quigley Furnace Specialties Co., Inc., New York.

Furnaces, Annealing, Brazing, Etc.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Metals Production Equipment Co., New York.
Rockwell, W. S., Co., New York.

Furnaces, Babbitt and Spelter.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Paxson, J. W., Co., Philadelphia, Pa.

Furnace Engineers (See Engineers, Furnaces).

Furnaces, Galvanizing and Tinning.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Metals Production Equipment Co., New York.
Rockwell, W. S., Co., New York.

Furnaces, Melting, for Oil, Coal, Coke or Gas (See also Foundry Supplies).
Buckeye Products Co., Cincinnati, O.
General Electric Co., Schenectady, N. Y.
Hawley Down Draft Furnace Co., Easton, Pa.
Ideal Furnace Co., Chester, Pa.
Metals Production Equipment Co., New York.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Obermayer, The S., Co., Pittsburgh, Pa.
Paxson, J. W., Co., Philadelphia, Pa.
Rockwell, W. S., Co., New York.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces, Powdered Coal Burning.
Metals Production Equipment Co., New York.
Monarch Engineering & Mfg. Co., Baltimore, Md.

Furnaces, Reverberatory.
Hawley Down Draft Furnace Co., Easton, Pa.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Rockwell, W. S., New York.

Galvanized Specialties, Nails, Screws, Etc.
Hassall, John, Inc., Brooklyn, N. Y.
National Galvanizing & Plating Equipment Corporation, New York.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Galvanizing Equipment.
Bennett-O'Connell Co., Chicago, Ill.
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
National Galvanizing & Plating Equipment Corporation, New York.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Galvanizing Equipment, Hot.
Watrous, E. L., Galvanizing Co., Des Moines, Ia.

Galvanizing for the Trade.
Hassall, John, Inc., Brooklyn, N. Y.
Meaker Galvanizing Co., Chicago, Ill.
Mohegan Tube Co., Brooklyn, N. Y.
National Galvanizing, Plating & Equipment Co., New York.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Galvanizing, Hot.
Watrous, E. L., Galvanizing Co., Des Moines, Ia.

Gas Producers and Power Plants.
Wood, R. D., & Co., Philadelphia, Pa.

Generators and Motors (See also Dynamos, Etc).
General Electric Co., Schenectady, N. Y.

German Silver Ingots, Castings, Sheets, Wire, Rods, Tubes.
American Brass Co., Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Bristol Brass Co., Bristol, Conn.
Dueber Watch Case Mfg. Co., Canton, O.
Pilling Brass Co., Waterbury, Conn.
Scovill Manufacturing Co., Waterbury, Conn.
Seymour Manufacturing Co., The, Seymour, Conn.
Stamford Rolling Mills, Inc., New York.
Trumphour-Whitehead Co., New York.

Gold Alloys.
American Boron Products Co., Reading, Pa.
Handy & Harman Co., New York.
Ney, The J. M. Company, Hartford, Conn.

Gold Anodes (See Anodes, Gold).

Gold, Chloride of.
Cooper, Charles, & Co., New York.

Gold Foil.
Ney, The J. M., Company, Hartford, Conn.

Gold, Ingots, Bars, Plates, Etc.
Handy & Harman, New York.
Ney, The J. M., Company, Hartford, Conn.

Gold and Silver Refiners.
Handy & Harman, New York.
Jackson, John J., Co., Newark, N. J.
Ney, The J. M., Company, Hartford, Conn.
Roessler & Hasslacher Chemical Co., New York.
Stein, William A., Newark, N. J.

Gold Solders.
Ney, The J. M. Company, Hartford, Conn.

Gold Trysalyt.
Roessler & Hasslacher Chemical Co., New York.

Grinding Machinery.
Bennett-O'Connell Co., Chicago, Ill.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Divine Brothers Co., Utica, N. Y.
Gardner Machine Co., Beloit, Wis.
Gem Mfg. Co., N. S., Pittsburgh, Pa.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Hardness Testing Instruments.
Holz, Herman A., New York.
Shore Instrument Co., New York.

Hinge Machinery.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Hoists, Electric, Pneumatic, Hand.
Whiting Foundry Equipment Co., Harvey, Ill.

Hot Galvanizing Machine.
Watrous, E. L., Galvanizing Co., Des Moines, Ia.

Hydraulic Accumulators.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Hydraulic Machinery, Presses, Jacks, Etc.
General Briquetting Co., New York.
Mesta Machine Co., Pittsburgh, Pa.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co,, Philadelphia, Pa.

Hytempite Furnace Cement.
Quigley Furnace Specialties Co., Inc., New York.

Indicators, Heat.
Taylor Instrument Companies, Rochester, N. Y.

Ingots, Brass-Briquet.
Eastern Brass & Ingot Corp., Waterbury, Conn.

Insulating Brick.
Armstrong Cork & Insulation Co., Pittsburgh, Pa.

Japanning Ovens (See Enameling and Japanning Ovens).

Japans.
Apothecaries Hall Co., Waterbury, Conn.

Jewelers' Bars.
Dueber Watch Case Mfg. Co., Canton, O.

Jewelers' Equipment and Supplies (See also Supplies).
Astle, H. J., & Co., Newark, N. J.
Leiman Bros., New York.
No-Dust Drying Machine Co., Providence, R. I.
Smith, Richardson Co., Attleboro, Mass.
Tolhurst Machine Works, Troy, N. Y.

Jewelers' Gold, Platinum and Silver Solders.
Ney, The J. M., Company, Hartford, Conn.

Jewelers' Findings.
Smith, Richardson Co., Attleboro, Mass.

Kalye.
Anthony Co., H. M., New York.

Laboratories, Consulting.
Harris Laboratory, Inc., New York.
Ledoux & Co., New York.
Norton Laboratories, Inc., Lockport, N. Y.
Ricketts & Co., New York.

Lacquering Ovens (See Enameling Ovens).

Lacquer Sprayers (See Air Brushes, Etc).

Lacquers and Enamels (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Barrett, M. L., & Co., Chicago, Ill.
Celluloid Zapon Co., New York.
Cooper, Charles, & Co., New York.
Dupont Chemical Works, New York.
Egyptian Lacquer Manufacturing Co., New York.
Eureka Pneumatic Spray Co., Inc., New York.
General Bakelite Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Kalbfleisch Corporation, The, New York.

Ladle Heaters and Dryers (See Foundry Supplies).

Lathes, Brass Finishers.
Bliss, E. W., & Co., Brooklyn, N. Y.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Lathes, Spinning.
Pryibil, P., Machine Co., Inc., New York.

Lead, Antimonial.
Ajax Metal Co., Philadelphia, Pa.
Leavitt, C. W., & Co., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Union Smelting & Refining Co., Inc., New York.

Lead, Burning.
Chadwick-Boston Lead Co., Boston, Mass.
Wiarda, John C., & Co., Brooklyn, N. Y.

Lead, Came.
Union Smelting & Refining Co., Inc., New York.

Lead Castings, Antimonial.
Ajax Metal Co., Philadelphia, Pa.
North American Smelting Co., Philadelphia, Pa.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Union Smelting & Refining Co., Inc., New York.

Leaden Ware, Lead Tanks, Etc.
Chadwick-Boston Lead Co., Boston, Mass.
Wiarda & Co., John C., Brooklyn, N. Y.

Lead, Pig and Bar.
American Zinc, Lead & Smelting Co., Boston, Mass.
Birkenstein, S., & Sons, Chicago, Ill.
Chadwick-Boston Lead Co., Boston, Mass.
Coates, Bennett & Reidenbach, Inc., Rochester, N. Y.
Eagle-Picher Lead Co., Chicago, Ill.
Great Western Smt. & Refg. Co., St. Louis, Mo.
Hendricks Bros., New York.
Hiertz Metal Co., Theo., St. Louis, Mo.
Michigan Smelting & Refining Co., Detroit, Mich.
Nassau Smtg. & Refg. Works, New York.
Richards & Co., Boston, Mass.
Seligman, Arthur, New York.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Syracuse Smelting Works, Brooklyn, N. Y.
Trotter, Nathan, & Co., Philadelphia, Pa.
Union Smelting & Refining Co., Inc., New York.
United Lead Co., New York.
United Metals Selling Co. New York.
United States Smelting Co., Inc., New York.
Weil, Louis, New York.
Wenger, Paul, & Co., New York.

Lead Pipe.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.
Union Smelting & Refining Co., Inc., New York.

Lead Strips and Moldings.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Union Smelting & Refinging Co., Inc., New York.

Lead Wire.
Union Smelting & Refining Co., Inc., New York.

Leather Meal for Dry Tumbling (See also Platers' Supplies).
Bennett-O'Connell Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.

Lubricants, Graphite.
Dixon, Joseph, Crucible Co., Jersey City, N. J.

Machine Work—Job and Contract.
American Brass Products Co., Pottstown, Pa.
Co-operative Engineering Co., New York.

Magnesium Metal.
American Magnesium Corp, Niagara Falls, N. Y.
Cooper, Charles, & Co., New York.
Goldschmidt Thermit Co., New York.
Leavitt, C. W., & Co., New York.
Norton Laboratories, Inc., Lockport, N. Y.
Roessler & Hasslacher Chemical Co., New York.
Rumford Metal Co., New York.

Magnesium Metal, Sheet, Wire, Ribbon, Powder, Etc.
American Magnesium Corp., Niagara Falls, N. Y.
Norton Laboratories, Inc., Lockport, N. Y.
Rumford Metal Co., New York.

Magnetic Metal Separators (See also Foundry Supplies).
Dings Magnetic Separator Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Magnetic Mfg. Co., Milwaukee, Wis.
Paxson, J. W., Co., Philadelphia, Pa.

Manganese, 98-99 Per Cent.
Goldschmidt Thermit Co., New York

Manganese Aluminum (10-90 per cent.).
Goldschmidt Thermit Co., New York.

Manganese Bronze.
Argus Smelting Co., New York.
Damascus Bronze Co., Pittsburgh, Pa.
Electric Smelting & Aluminum Co., Lockport, N. Y.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
White & Bro., Philadelphia, Pa.

Manganese Bronze Sheets, Rods, Etc.
Bridgeport Brass Co., Bridgeport, Conn.
Great Western Smt. & Rfg. Co., St. Louis, Mo.
Taunton-New Bedford Copper Co., New Bedford, Mass.

Manganese Copper.
Argus Smelting Co., New York.
Ajax Metal Co., Philadelphia, Pa.
Electric Smelting & Alum Co., Lockport, N. Y.
Goldschmidt Thermit Co., New York.
Lang, R. F., New York.
Leavitt, C. W., & Co., New York.
Roessler & Hasslacher Chemical Co., New York.

Manganese Metal.
Cooper, Charles, Co., New York.
Goldschmidt Thermit Co., New York.
Leavitt, C. W., New York.
Roessler & Hasslacher Chemical Co., New York.

Match Plates.
Turner Machine Co., Philadelphia, Pa.

Metal Briquettes.
Eastern Brass & Ingot Co., Waterbury, Conn.
General Briquetting Co., New York.

Metallurgists, Consulting.
Harris Laboratory, Inc., New York.
Ledoux & Co., New York.

Metals (See name of metal wanted).

Metals, Dealers in All Kinds of New (See also name of metal wanted).
Ajax Metal Co., Philadelphia, Pa.
Birkenstein, S., & Sons, Chicago, Ill.
Gardner Co., The B. M., Cleveland, O.
Loewenthal Co., The, Chicago, Ill.
Metal Export Co. of America, New York.
Nassau Smtg. and Rfg. Works, New York.
North Atlantic Metal Corp., New York.
Peninsular Smelting Co., Detroit, Mich.
Richards & Co., Boston, Mass.
Seligman, Arthur, New York.

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Syracuse Smelting Works, Brooklyn, N. Y.
Trotter, Nathan & Co., Philadelphia, Pa.
Wenger & Co., Paul, New York.
White & Bro., Philadelphia, Pa.

Metals, Dealers in Old.
Birkenstein, S., & Sons, Chicago, Ill.
Capper, Pass & Son, Ltd., Bristol, England.
Coates, Bennett & Reidenbach, Inc., Rochester, N. Y.
Herscopf & Son, Ch., Brooklyn, N. Y.
Lehman Bros., Hoboken, N. J.
Lowenthal Co., The, Chicago, Ill.
Metal Export Co. of America, New York.
Moers, E. M., Sons, New York.
Nassau Smtg. and Rfg. Works, New York.
North American Smelting Co., Philadelphia, Pa.
Peninsular Smelting Co., Detroit, Mich.
Radnai, Josef, New York.
Syracuse Smelting Works, Brooklyn, N. Y.
United Smelt. & Aluminum Co., New Haven, Conn.
Weil, Louis, New York.

Metals, Dealers in Old—Gold, Silver, Platinum.
Handy & Harman, New York.
Midgley & Prentice, Inc., New York.
Ney, The J. M., Company, Hartford, Conn.

Metal Goods Made to Order.
American Brass Co., Waterbury, Conn.
Autoyre Co., The, Oakville, Conn.
Baird Machine Co., Bridgeport, Conn.
Bossert Corporation, Utica, N. Y.
Bridgeport Brass Co., Bridgeport, Conn.
Gem Mfg. Co., N. S., Pittsburgh, Pa.
Manhattan Brass Co., New York.
Scovill Manufacturing Co., Waterbury, Conn.

Metals, Plated Sheet.
American Nickeloid Co., Peru, Ill.
Benson, H. K. & F. S., Glen Ridge, N. J.
National Sheet Metal Co., Peru, Ill.

Metal, Silver Plated Sheet.
Benson, H. K. & F. S., Glen Ridge, N. J.

Metals, Rare.
Norton Laboratories, Inc., Lockport, N. Y.
Radnai, Josef, New York.

Metal Refiners—White Metal.
Capper, Pass & Son., Ltd., Bristol, England.

Metals (Carbon Free).
Goldschmidt Thermit Co., New York.

Metal Turnings, Drosses, Residues, Etc., Buyers of.
Ajax Metal Co., Philadelphia, Pa.
Balbach Smelting & Refinery Co., Newark, N. J.
Birkenstein, S., & Sons, Chicago, Ill.
Capper, Pass & Son, Ltd., Bristol, England.
Great Western Smtg. & Refg. Co., St. Louis, Mo.
Herscopf & Son, C. H., Brooklyn, N. Y.
Lehman Bros., Hoboken, N. J.
Loewenthal Co., The, Chicago, Ill.
Metal Export Co. of America, New York.
Moers, E. M., Sons, New York.
Nassau Smtg. and Rfg. Works, New York.
North American Smelting Co., Philadelphia, Pa.
Peninsular Smelting Co., Detroit, Mich.
Radnai, Josef, New York.
Union Smelting & Refining Co., Inc., New York.
Weil, Louis, New York.
Whipple & Choate, Bridgeport, Conn.
White & Bro., Inc., Philadelphia, Pa.

Meters, Flow, Air, Gas and Water.
General Electric Co., Schenectady, N. Y.

Mineral Cleaner.
Electric Smelting & Alum'n Co., Lockport, N. Y.

Mixers for Gold and Silver Sweepings.
Mousette Co., O. J., Inc., Brooklyn, N. Y.

Modeling and Chasing (See Chasing and Modeling).

Mold Dryers, Portable (See also Foundry Supplies).
Monarch Engineering & Mfg. Co., Baltimore, Md.
Paxson, J. W., & Co., Philadelphia, Pa.

Mold Wash, Silica (See also Foundry Supplies).
Paxson, J. W., & Co., Philadelphia, Pa.

Molder's Tubs (See also Foundry Supplies).
Paxson, J. W., & Co., Philadelphia, Pa.

Molds, Ingot (See also Foundry Supplies).
Paxson, J. W., & Co., Philadelphia, Pa.

Molds, Water-Cooled, for Babbitt, Etc.
Schweizer, Chas. K., Co., St. Louis, Mo.

Molding Machines (See also Foundry Supplies).
Paxson, J. W., & Co., Philadelphia, Pa.
Turner Machine Co., Philadelphia, Pa.

Molding Sand (See Sand).

Monel Metal.
International Nickel Co., New York.

Mouldmakers.
Fogg, Arthur A., Meriden, Conn.
Vatter, Ernest, New York.

Muffles, Graphite.
Dixon, Jos., Crucible Co., Jersey City, N. J.

Muntz's Metal—Sheets, Rods, Bolts, Nails, Etc.
Taunton-New Bedford Copper Co., New Bedford, Mass.

Nails, All Metals.
Hassall, John, Brooklyn, N. Y.

Nichrome Dipping Baskets.
Driver-Harris Co., Harrison, N. J.

Nickel Alloys.
American Boron Products Co., Reading, Pa.

Nickel, Nickel Castings, Shot Nickel.
Apothecaries Hall Co., Waterbury, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Crown Rheostat & Supply Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Hendricks Bros., New York.
International Nickel Co., New York.
Leavitt, C. W., & Co., New York.
Munning-Loeb Co., Matawan, N. J.
Nassau Smtg. and Rfg. Works, New York.
Richards & Co., Boston, Mass.
Seligman, Arthur, New York.
Seymour Mfg. Co., Seymour, Conn.
Trotter, Nathan, & Co., Philadelphia, Pa.
Wenger & Co., Paul, New York.
Wiarda & Co., John C., Brooklyn, N. Y.

Nickel-Bronze Castings and Ingots.
Ajax Metal Co., Philadelphia, Pa.
Damascus Bronze Co., Pittsburgh, Pa.
Weil, Louis, New York.

Nickel Plating (See Electroplating).

Nickel Salts.
Apothecaries Hall Co., Waterbury, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Cooper, Charles, & Co., New York.
Crown Rheostat & Supply Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Harshaw, Fuller & Goodwin Co., Cleveland, O.
Munning-Loeb Co., Matawan, N. J.
Neubeck, Adolf, Buffalo, N. Y.
New York Buff Co., New York.
Roessler & Hasslacher Chemical Co., New York.
Wiarda & Co., John C., Brooklyn, N. Y.

Nickel Salts for Rapid Plating.
Neubeck, Adolf, Buffalo, N. Y.

Nickel Scrap.
Moers' Sons, E. M., New York.

Nickel Sheets.
Seymour Mfg. Co., Seymour, Conn.

Nickel Silver Tubes.
Wells, A. H., & Co., Waterbury, Conn.

Nut Blanking Machines.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Oil Pumps and Storage Tanks.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Metals Production Equipment Co., New York.
Rockwell Co., W. S., New York.

Oils, Core (See also Foundry Supplies).
Paxson, J. W., & Co., Philadelphia, Pa.

Oils, Tempering and Lubricating.
Apothecaries Hall Co., Waterbury, Conn.

Ornamental Bronze Castings.
Vatter, Ernest, New York.

Oven Insulation.
Armstrong Cork & Insulation Co., Pittsburgh, Pa.

Ovens (See Baking, Enameling and Sherardizing Ovens, also Foundry Supplies).

Overhead Trolleys and Tracks.
New Jersey Foundry & Machine Co., New York.
Whiting Foundry Equipment Co., Harvey, Ill.

Pan Grinders and Mixers.
Paxson, J. W., Co., Philadelphia, Pa.

Parting Compounds (See also Foundry Supplies).
Paxson, J. W., Co., Philadelphia, Pa.

Pattern Metal.
Ajax Metal Co., Philadelphia, Pa.
North American Smelting Co., Philadelphia, Pa.

Pattern Letters and Figures.
Paxson, J. W., Co., Philadelphia, Pa.

Patterns, Metal.
Turner Machine Co., Philadelphia, Pa.

Pewter.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Phosphor Bronze Ingots, Castings, Etc.
Argus Smelting Co., New York.
Ajax Metal Co., Philadelphia, Pa.
Damascus Bronze Co., Pittsburgh, Pa.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Seligman, Arthur, New York.
Seymour Mfg. Co., Seymour, Conn.

Phosphor Bronze Sheets, Wire Rods, Etc.
Bridgeport Brass Co., Bridgeport, Conn.
Nassau Smtg. and Rfg. Works, New York.
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Pilling Brass Co., Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.
Trumpbour Whitehead Co., New York.

Phosphor Copper and Phosphor Tin.
Argus Smelting Co., New York.
Ajax Metal Co., Philadelphia, Pa.
Coates, Bennett & Reidenbach, Inc., Rochester, N. Y.
Damascus Bronze Co., Pittsburgh, Pa.
Electric Smelt. & Aluminum Co., Lockport, N. Y.
Goldschmidt Thermit Co., New York.
Great Western Smtg. & Refg. Co., St. Louis, Mo.
Lang, R. F., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
New Era Mfg. Co., Kalamazoo, Mich.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Roessler & Hasslacher Chemical Co., New York.
Seligman, Arthur, New York.
Syracuse Smelting Works, Brooklyn, N. Y.
Wenger & Co., Paul, New York.

Phosphorizers (See Crucibles, Etc.).

Phosphorus (See also Foundry Supplies).
General Chemical Co., Philadelphia, Pa.
Paxson, J. W., Co., Philadelphia, Pa.

Pickling Compounds.
Hanson & Van Winkle Co., Newark, N. J.

Pickling Machines, Automatic.
Mesta Machine Co., Pittsburgh, Pa.
Torrington Manufacturing Co., Torrington, Conn.

Pipe Covering.
Armstrong Cork & Insulation Co., Pittsburgh, Pa.

Plastic Bronze.
Ajax Metal Co., Philadelphia, Pa.
American Boron Products Co., Reading, Pa.

Plated Sheet Metal (See Metals, Plated Sheet).

Platers' Metal (See also Platers' Supplies).
Kemp, W. H., Co., New York.
Pilling Brass Co., Waterbury, Conn.

Platers', Polishers', and Galvanizers' Equipment and Supplies.
Abbott Ball Co., Hartford, Conn.
Alden Speare's Sons Co., Cambridge, Mass.
Allington & Curtis Mfg. Co., Chicago, Ill.
American Chemical Paint Co., Philadelphia, Pa.
Ames Sword Co., Chicopee, Mass.
Anthony, H. M., Co., New York.
Apothecaries Hall Co., Waterbury, Conn.
Astle, H. J., & Co., Providence, R. I.
Automatic Buffing Machine Co., Buffalo, N. Y.
Baird Machine Co., Bridgeport, Conn.
Barrett, M. L., & Co., Chicago, Ill.
Bennett-O'Connell Co., Chicago, Ill.
Blumenthal, H., & Co., New York.
Bogue, Chas. J., Electric Co., New York.
Buchanan, C. G., Chemical Co., Cincinnati, O.
Burns, E. Reed, Supply Co., Brooklyn, N. Y.
Cleveland Blow Pipe & Mfg. Co., Cleveland, O.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Cooper, Charles, & Co., New York.
Corcoran, A. J., Inc., Jersey City, N. J.
Crown Rheostat & Supply Co., Chicago, Ill.
Divine Brothers Co., Utica, N. Y.
Driver-Harris Co., Harrison, N. J.
Eager Electric Co., Watertown, N. Y.
Ely, C. Upham, New York.
Ford, J. B., Co., Wyandotte, Mich.
Franco-American Chemical Co., Carlstadt, N. J.
Gardner Machine Co., Beloit, Wis.
Gem Mfg. Co., N. S., Pittsburgh, Pa.
General Chemical Co., Philadelphia, Pa.
General Electric Co., Schenectady, N. Y.
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
Harshaw, Fuller & Goodwin Co., Cleveland, O.
Hauser-Stander Tank Co., Cincinnati, O.
Hegeler Zinc Co., Danville, Ill.
House & Sons, Chas. W., Unionville, Conn.
International Chemical Co., Camden, N. J.
Jackson, John J., & Co., Newark, N. J.
Jackson Mills Emery Co., Odenweldertown, Easton, Pa.
Jantz & Leist Co., Cincinnati, O.
Kalamazoo Tank & Silo Co., Kalamazoo, Mich.
Kalbfleisch Corporation, The, New York.
Kirk & Blum Co., Cincinnati, O.
Leiman Bros., New York.
L'Hommedieu, Chas. F., Sons & Co., Chicago, Ill.
Manufacturers' Brush Co., Cleveland, O.
Munning-Loeb Co., Matawan, N. J.
National Galv. & Plat. Equip. Corp., New York.
New York Buff Co., New York.
No-Dust Drying Machine Co., Providence, R. I.
Oakley Chemical Co., New York.
Parsons Mfg. Co., The, Chicago, Ill.
Pryibil Machine Co., P., New York.
Rhodes, Jas. H., & Co., Chicago, Ill.
Roessler & Hasslacher Chemical Co., New York.
Smith, John P., & Co., New Haven, Conn.
Smith, Richardson Co., Attleboro, Mass.
Solvay Process Co., Syracuse, N. Y.
Stearns, A. T., Lumber Co., Boston, Mass.
Tolhurst Machine Works, Troy, N. Y.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.
U. S. Smelting Co., Inc., New York.
Wiarda & Co., John C., Brooklyn, N. Y.
Wodison, E. J., Co., Detroit, Mich.
Yorkville Mfg. Co., New York.

Plating Job (See Electroplating, Polishing, Etc).

Platinum.
Handy & Harman, New York.
Roessler & Hasslacher Chemical Co., New York.
Stein, William A., Newark, N. J.
United States Smelting Co., Inc., New York.

Platinum, Sheet, Wire, Solder.
Handy & Harman, New York.

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Ney, The J. M., Company, Hartford, Conn.
Roessler & Hasslacher Chemical Co., New York.

Platinum Scrap, Buyers of.
Handy & Harman, New York.
Ney, The J. M., Company, Hartford, Conn.
Radnai, Josef, New York.
Roessler & Hasslacher Chemical Co., New York.
Stein, William A., Newark, N. J.

Platinum Solder.
Ney, The, J. M., Company, Hartford, Conn.

Plumbago (See also Foundry Supplies).
Paxson, J. W., Co., Philadelphia, Pa.

Polishing and Buffing (See also Electro-Plating, Etc.).
Sievering, Philip, New York.
Terrace Electro Plating Co., New York.

Polishing and Grinding Engineers.
Divine Brothers Co., Utica, N. Y.

Polishing, Buffing and Burnishing Machinery and Supplies (See Platers' Supplies).

Polishing, Belts, Endless (See also Platers' Supplies).
Ames Sword Co., Chicopee, Mass.
Bennett-O'Connell Co., Chicago, Ill.
Divine Brothers Co., Utica, N. Y.
Munning-Loeb Co., Matawan, N. J.

Polishing Wheels, Sheepskin.
Jackson Mill Emery Co., Odenweldertown, Easton, Pa.
Yorkville Mfg. Co., New York.

Potash (See Platers' Supplies).

Presses, Bench and Foot.
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Leiman Bros., New York.
Shuster, The F. B., Co., New Haven, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Presses, Cabbaging.
Paxson, J. W., Co., Phialdelphia, Pa.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Presses, Coining.
Bliss, E. W., Co., Brooklyn, N. Y.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Presses, Drop.
Bliss, E. W., Co., Brooklyn, N. Y.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Presses, Hydraulic.
General Briquetting Co., New York.
Mesta Machine Co., Pittsburgh, Pa.

Presses, Power.
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Consol'dated Press Co., Hastings, Mich.
Garrison, A., Foundry Co., Pittsburgh, Pa.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Pressure Blowers (See also Foundry Supplies).
Astle, H. J., & Co., Providence, R. I.
Eclipse Air Brush Co., Newark, N. J.
Eureka Pneumatic Spray Co., Inc., New York.
General Electric Co., Schenectady, N. Y.
Leiman Bros., New York.
Monarch Engineering & Mfg. Co., Baltimore, Md.
New Haven Sand Blast Co., New Haven, Conn.
Paxson, J. W., Co., Philadelphia, Pa.
Vapor Valve Co., St. Louis, Mo.
Whiting Foundry Equipment Co., Harvey, Ill.

Pumice.
Baird Machine Co., Bridgeport, Conn.
Paxson, J. W., Co., Philadelphia, Pa.
Rhodes, Jas. H., & Co., Chicago, Ill.

Pyroscopes.
Shore Instrument Co., New York.

Pyrometers.
Holz, Herman A., New York.
Taylor Instrument Companies, Rochester, N. Y.

Pyrometers, Rare Metal Thermo Couple.
Taylor Instrument Companies, Rochester, N. Y.

Pyrometer Shields.
Dixon, Jos., Crucible Co., Jersey City, N. J.

Recording Instruments.
Taylor Instrument Companies, Rochester, N. Y.

Refiners, Metal (See Smelters and Refiners).

Retorts, Graphite.
Dixon, Jos., Crucible Co., Jersey City, N. J.

Rheostats (See Platers' Supplies).

Riveting Machines.
Shuster, The F. B., Co., New Haven, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Wood, R. D., & Co., Philadelphia, Pa.

Rivets—Brass, Aluminum, Etc.
Hassall, John, Inc., New York.
Hendricks Bros., New York.
Kemp, W. H., Co., New York.

Roll-Grinding Machines.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Rolls, Chilled and Sand.
Garrison, A., Fdy. & Machine Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Rolls, Jewelers'.
Leiman Bros., New York.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Rolling Mill Machinery.
Continuous Casting Corporation, New York.
Garrison, A., Fdy. & Machine Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Rouge.
Rhodes, Jas. H., & Co., Chicago, Ill.

Sand, Fire (See also Foundry Supplies).
Paxson, J. W., Co., Philadelphia, Pa.

Sand for Blasting.
Paxson, J. W., Co., Philadelphia, Pa.
U. S. Silica Co., Chicago, Ill.

Sand Blast Accessories and Supplies.
Pangborn Corporation, Hagerstown, Md.

Sand Blast Cars.
Pangborn Corporation, Hagerstown, Md.

Sand Blast Tumbling Barrels, Machinery and Equipment.
Astle, H. J., & Co., Providence, R. I.
Brown Specialty Machinery Co., Chicago, Ill.
Leiman Bros., New York.
Mott Sand Blast Mfg. Co., New York.
New Haven Sand Blast Co., New Haven, Conn.
Pangborn Corporation, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Whiting Foundry & Equipment Co., Harvey, Ill.

Sand Dryers (See Foundry Supplies).

Sand Separators.
Pangborn Corporation, Hagerstown, Md.

Sand Sifters and Mixers.
Brown Specialty Machinery Co., Chicago, Ill.
Paxson, J. W., Co., Philadelphia, Pa.
Turner Machine Co., Philadelphia, Pa.
Wadsworth Core Machine & Equip. Co., Akron, O.
Whiting Foundry Equipment Co., Harvey, Ill.

Sand, Molding (See also Foundry Supplies).
Paxson, J. W., Co., Philadelphia, Pa.

Sawdust, For Drying Purposes (See also Platers' Supplies).
Bennett-O'Connell Co., Chicago, Ill.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F. & Sons Co., Chicago, Ill.
National Sawdust Co., Brooklyn, N. Y.
Wiarda, John C., & Co., Brooklyn, N. Y.

Sawdust Drying-Out Boxes (See also Platers' Supplies).
Astle, H. J., & Co., Providence, R. I.
Bennett-O'Connell Co., Chicago, Ill.
Hanson & Van Winkle, Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
No-Dust Drying Machine Co., Providence, R. I.
Smith, Richardson Co., Attleboro, Mass.
Steiner, E. E., Newark, N. J.

Scleroscope.
Shore Instrument Co., New York.

Scrap Metals (See Metal Turnings, Drosses, Residues, Etc.).

Scrap—Renewing Metal Alloys.
American Boron Products Co., Reading, Pa.

Separators, Magnetic (See Magnetic Metal Separators).

Separators, Oil and Moisture.
Pangborn Corporation, Hagerstown, Md.

Shafting, Forged Steel.
Mesta Machine Co., Pittsburgh, Pa.

Shanks, Ladles and Crucibles.
Paxson, J. W., Co., Philadelphia, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Shears, Power.
Bliss, E. W., Co., Brooklyn, N. Y.
Garrison, A., Fdy. & Machine Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Sheet Metal Straightening, Cutting and Forming Machinery.
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Shuster, The F. B., Co., New Haven, Conn.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Sherardizing (See also Galvanizing).
Globe Machine & Stamping Co., Cleveland, O.
Mohegan Tube Co., Brooklyn, N. Y.

Sherardizing Ovens.
Gehnrich Indirect Heat Oven Co., Brooklyn, N. Y.
General Electric Co., Schenectady, N. Y.
Globe Machine & Stamping Co., Cleveland, O.
Monarch Engineering & Mfg. Co., Baltimore, Md.

Silica Sand.
U. S. Silica Co., Chicago, Ill.

Silica, Pulverized.
Paxson, J. W., Co., Philadelphia, Pa.
U. S. Silica Co., Chicago, Ill.

Shop Pans.
Paxson, J. W., Co., Philadelphia, Pa.

Silicon.
Leavitt, C. W., & Co., New York.
Rhodes & Co., Jas. H., Chicago, Ill.

Silicon Copper.
Ajax Metal Co., Philadelphia, Pa.
Damascus Bronze Co., Pittsburgh, Pa.
Electric Smelting & Alum'n Co., Lockport, N. Y.
Goldschmidt Thermit Co., New York.
Lang, R. F., New York.
Roessler & Hasslacher Chemical Co., New York.

Silver Alloys.
American Boron Products Co., Reading, Pa.

Silver and Gold Granulated.
Handy & Harman, New York.
Jackson, John J., & Co., Newark, N. J.
Ney, The J. M., Co., Hartford, Conn.

Silver Cyanide.
Apothecaries Hall Co., Waterbury Conn.
Roessler & Hasslacher Chemical Co., New York.

Silver, Nitrate and Chloride of (See also Platers' Supplies).
Buchanan, C. G., Chemical Co., Cincinnati, O.
Handy & Harman, New York.
Jackson, John J., & Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.

Silver Ingots, Bars, Plates, Etc.
Handy & Harman, New York.
Jackson, John J., & Co., Newark, N. J.
Ney, The J. M., Company, Hartford, Conn.

Silver Refiners.
Handy & Harman, New York.
Jackson, John J., Co., Newark, N. J.
Ney, The J. M., Company, Hartford, Conn.
Roessler & Hasslacher Chemical Co., New York.
Stein, William A., Newark, N. J.

Silver, Rolled Sterling.
Handy & Harman, New York.
Jackson, John J., & Co., Newark, N. J.
Ney, The J. M., Company, Hartford, Conn.

Silver Solder.
Ney, The J. M., Company, Hartford, Conn.

Silver Trysalyt.
Roessler & Hasslacher Chemical Co., New York.

Silver Wire.
Handy & Harman, New York.
Jackson John J., Co., Newark, N. J.
Ney, The J. M., Company, Hartford, Conn.

Slitting Machines.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Smelters of Copper-Bearing Materials.
Ajax Metal Co., Philadelphia, Pa.
Balbach Smelting & Refining Co., Newark, N. J.
Capper, Pass & Son, Ltd., Bristol, England.
Great Western Smtg. & Refg. Co., St. Louis, Mo.
North American Smelting Co., Philadelphia, Pa.
Syracuse Smelting Works, Brooklyn, N. Y.
Whipple & Choate, Bridgeport, Conn.
White & Bro., Philadelphia, Pa.

Smelters and Refiners, Gold and Silver.
Handy & Harman, New York.
Ney, The J. M., Company, Hartford, Conn.
Roessler & Hasslacher Chemical Co., New York.
Stein, William A., Newark, N. J.

Smelters and Refiners—White Metal.
Ajax Metal Co., Philadelphia, Pa.
Birkenstein, S., & Sons, Chicago, Ill.
Capper, Pass, & Son, Ltd., Bristol, England.
Great Western Smtg. & Refg. Co., St. Louis, Mo.
Herscopf & Son, Ch., Brooklyn, N. Y.
Lehman Bros., Hoboken, N. J.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Syracuse Smelting Works, Brooklyn, N. Y.
White & Bro., Philadelphia, Pa.

Soap (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
International Chemical Co., Camden, N. J.
Munning-Loeb Co., Matawan, N. J.
Wiarda, John C., & Co., Brooklyn, N. Y.

Solder, Aluminum.
Allen, L. B., Co., Inc., Chicago, Ill.
Aluminum Company of America, Pittsburgh, Pa.
Electric Smelt. & Aluminum Co., Lockport, N. Y.
Kemp, W. H., Co., New York.
Richards & Co., Boston, Mass.
Syracuse Smelting Works, Brooklyn, N. Y.
United Smelt. & Alum'n Co., New Haven, Conn.

Solder, Brazing.
Ajax Metal Co., Philadelphia, Pa.
Allen, L. B., Inc., Chicago, Ill.
American Brass Co., Waterbury Brass Branch, Waterbury, Conn.
Great Western Smtg. & Refg. Co., St. Louis, Mo.
Hussey, C. G., & Co., Pittsburgh, Pa.
Nassau Smtg. and Refg. Works, New York.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Syracuse Smelting Works, Brooklyn, N. Y.
Union Smelting & Refining Co., New York.

Solder, Wire.
Ney, The J. M., Company, Hartford, Conn.
North American Smelting Co., Philadelphia, Pa.

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Standard Rolling Mills, Inc., Brooklyn, N. Y.
Syracuse Smelting Works, Brooklyn, N. Y.
Union Smelting & Refining Co., New York.

Soldering Flux.
Allen, L. B., Co., Inc., Chicago, Ill.
Crown Rheostat & Supply Co., Chicago, Ill.
L'Hommedieu, Chas. F., Sons & Co., Chicago, Ill.
Ney, The J. M., Company, Hartford, Conn.
Norton Laboratories, Inc., Lockport, N. Y.
Richards & Co., Boston, Mass.
Wiarda, John C., & Co., Brooklyn, N. Y.

Soldering Irons.
Hendricks Bros., New York.
Hussey, C. G., & Co., Pittsburgh, Pa.
Taunton-New B'fd Copper Co., New Bedford, Mass.

Soldering Tools, Gas.
Allen, L. B., Inc., Chicago, Ill.

Solder Molds.
Paxson, J. W., Co., Philadelphia, Pa.
Schweizer, Chas. K., Co., St. Louis, Mo.

Solder, Silver.
Handy & Harman, New York.
Jackson, John J., & Co., Newark, N. J.
Ney, J. M., & Co., Hartford, Conn.

Solder, Tinners'.
Allen, L. B., Co., Inc., Chicago, Ill.
Columbia Smelting & Refining Works, New York.
Great Western Smtg. & Refg. Co., St. Louis, Mo.
Hiertz Metal Co., Theo., St. Louis, Mo.
Michigan Smelting & Refining Co., Detroit, Mich.
Nassau Smtg. and Rfg. Works, New York.
New Era Mfg. Co., Kalamazoo, Mich.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Syracuse Smelting Works, Brooklyn, N. Y.
Union Smelting & Refining Co., New York.

Solder Wire.
Union Smelting & Refining Co., New York.

Soluble Cotton.
Dupont Chemical Works, New York.
Wiarda, John C., & Co., Brooklyn, N. Y.

Spelter.
Ajax Metal Co., Philadelphia, Pa.
American Zinc, Lead & Smelting Co., New York.
Birkenstein, S., & Sons, Chicago, Ill.
Coates, Bennett & Reidenbach, Inc., Rochester, N. Y.
Damascus Bronze Co., Pittsburgh, Pa.
Eagle-Picher Lead Co., Chicago, Ill.
Eastern Zinc Refining Co., New York.
Electrolytic Zinc Co., Inc., New York.
Fort Smith Spelter Co., Warren, O.
General Smelting Corp., New York.
Great Western Smtg. & Refg. Co., St. Louis, Mo.
Hegeler Zinc Co., Danville, Ill.
Hendricks Bros., New York.
Hiertz Metal Co., Theo., St. Louis, Mo.
Leavitt, C. W., & Co., New York.
Loewenthal Co., The, Chicago, Ill.
Matthiesen & Hegeler Zinc Co., La Salle, Ill.
Metals Trading Corporation, New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Nassau Smtg. and Refining Works, New York.
New Jersey Zinc Co., The, New York.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Seligman, Arthur, New York.
Syracuse Smelting Works, Brooklyn, N. Y.
Trotter, Nathan, & Co., Philadelphia, Pa.
Union Smelting & Refining Co., New York.
United Lead Co., New York.
United States Smelting Co., Inc., New York.
United Zinc Smelting Co., New York.
Weil, Louis, New York.
Wenger, Paul, & Co., New York.

Spelter Solder (See Solder, Brazing).

Spelter Bowls.
Dixon, Jos., Crucible Co., Jersey City, N. J.

Spinning Lathes.
Bliss, E. W., Co., Brooklyn, N. Y.
Pryibil Machine Co., P., Inc., New York.

Spinning Metal (See also Metal Goods Made to Order).
Standard Rolling Mills, Brooklyn, N. Y.

Sponges.
Rhodes, Jas. H., & Co., Chicago, Ill.

Spraying Machines and Hoods, Tables, Etc., for Lacquer, Japan, Enamel, Etc.
De Vilbiss Mfg. Co., Toledo, O.
Eclipse Air Brush Co., Newark, N. J.
Eureka Pneumatic Spray Co., Inc., New York.
Holton, B. E., Co., Los Angeles, Cal.
Vapor Valve Co., St. Louis, Mo.

Sprue Cutters (See also Foundry Supplies).
Bliss, E. W., Co., Brooklyn, N. Y.
Obermayer, The S., Co., Pittsburgh, Pa.
Paxson, J. W., Co., Philadelphia, Pa.
Shuster, The F. B., Co., New Haven, Conn.
Turner Machine Co., Philadelphia, Pa.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Stamping and Drawing, Metal (See also Metal Goods made to order).
Autoyre Co., The, Oakville, Conn.
Bossert Corporation, Utica, N. Y.
Bridgeport Brass Co., Bridgeport, Conn.
Cleveland (Ohio) Metal Products Co., Ivanhoe Plant.
Gem Mfg. Co., N. S., Pittsburgh, Pa.
Globe Machine & Stamping Co., Cleveland, O.
Metals Production Equipment Co., New York.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Steel Tubing.
Mohegan Tube Co., Brooklyn, N. Y.

Sterling Silver Sheets.
Jackson, John J., Newark, N. J.
Ney, The J. M., Company, Hartford, Conn.

Stirrers, Graphite (See Crucibles, Etc.).

Stoneware, Chemical.
Burns, E. Reed, Supply Co., Brooklyn, N. Y.
General Ceramics Co., New York.

Stoneware, Exhaust Fans.
General Ceramics Co., New York.

Stoneware Tanks, Dipping Baskets, Etc.
Bennett-O'Connell Co., Chicago, Ill.
Burns, E. R., Supply Co., Brooklyn, N. Y.
General Ceramics Co., New York.
L'Hommedieu, Chas. F., Sons & Co., Chicago, Ill.
Munning-Loeb Co., Matawan, N. J.
Wiarda, John C., & Co., Brooklyn, N. Y.

Sulphuret of Potassium (See Platers' Supplies).

Swaging Machines, Tube and Rod.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Sweep Smelters (See Smelters, Sweep).

Tanks, Electroplaters' (See also Platers' Supplies).
Astle, H. J., & Co., Providence, R. I.
Bennett-O'Connell Co., Chicago, Ill.
Burns, E. Reed, Supply Co., Brooklyn, N. Y.
Chadwick-Boston Lead Co., Boston, Mass.
Corcoran, A. J., Inc., Jersey City, N. J.
General Ceramics Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Hauser-Stander Tank Co., Cincinnati, O.
Kalamazoo Tank & Silo Co., Kalamazoo, Mich.
Munning-Loeb Co., Matawan, N. J.
Stearns, The A. T., Lumber Co., Boston, Mass.
Wiarda, John C., & Co., Brooklyn, N. Y.

Tanks, Stoneware (See also Platers' Supplies).
Burns, E. Reed, Supply Co., Brooklyn, N. Y.
General Ceramics Co., New York.
L'Hommedieu, Chas. F., Sons & Co., Chicago, Ill.

Testing, Laboratories.
Ledoux & Co., New York.
Ricketts & Co., New York.

Thermometers, Plating Bath.
Taylor Instrument Companies, Rochester, N. Y.

Thermometers, Potash Tank.
Taylor Instrument Companies, Rochester, N. Y.

Thread Rolling Machines.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Tin, Chloride of.
Apothecaries Hall Co., Waterbury, Conn.
Wiarda, John C., & Co., Brooklyn, N. Y.

Tin, Chemically Pure.
Ney, The J. M., Company, Hartford, Conn.

Tinning Equipment.
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
National Galvanizing & Plating Equipment Corporation, New York.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Tin, Pig, Bar and Block.
Birkenstein, S., & Sons, Chicago, Ill.
Great Western Smtg. & Refg. Co., St. Louis, Mo.
Hendricks Bros., New York.
Hiertz Metal Co., Theo., St. Louis, Mo.
Leavitt, C. W., & Co., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Nassau Smelting & Refining Works, New York.
Richards & Co., Boston, Mass.
Seligman, Arthur, New York.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Syracuse Smelting Works, Brooklyn, N. Y.
Trotter, Nathan, & Co., Philadelphia, Pa.
Union Smelting & Refining Co., Inc., New York.
Weil, Louis, New York.
Wenger, Paul, & Co., New York.

Tin Tubing.
Chadwick-Boston Lead Co., Boston, Mass.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.
Union Smelting & Refining Co., Inc., New York.

Tin, Sheet Block.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Titanium Alloys.
Goldschmidt Thermit Co., New York.

Tobin Bronze.
American Brass Co., Waterbury, Conn.

Tongs, Crucible and Pick-Up.
N. J. Foundry & Machine Co., New York.
Paxson, J. W., Co., Philadelphia, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Tools, Jigs, Fixtures, Etc.
Sholes Standard Typewriter Co., Garfield, N. J.

Tube Mill Machinery.
Torrington Mfg. Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Tubes (See name of metal wanted).
Richards & Co., Boston, Mass.

Tumbling Barrels (See Foundry Supplies and Platers' Supplies).

Type Metal (See White Metal Ingots).

Turntables, Cars, Etc.
Paxson, J. W., Co., Philadelphia, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Vacuum Pumps.
Leiman Bros., New York.

Vanadium Alloys.
Goldschmidt Thermit Co., New York.

Ventilators and Apparatus (See Dust Collectors, Etc.).

Vibrators (See also Foundry Supplies and Equipment).
Malleable Iron Fittings, Branford, Conn.
Woodison Co., E. J., Detroit, Mich.

Voltmeters (See Platers', Polishers', and Galvanizers' Supplies).

Wattmeters.
General Electric Co., Schenectady, N. Y.

Welding Apparatus, Arc.
General Electric Co., Schenectady, N. Y.

White Metal Ingots.
Ajax Metal Co., Philadelphia, Pa.
Columbia Smelting & Refining Works, New York.
Great Western Smtg. & Refg. Co., St. Louis, Mo.
Hiertz Metal Co., Theo., St. Louis, Mo.
New Era Mfg. Co., Kalamazoo, Mich.
North American Smelting Co., Philadelphia, Pa.
Syracuse Smelting Works, Brooklyn, N. Y.
Union Smelting & Refining Co., New York.
Wenger, Paul, & Co., New York.
White & Bro., Philadelphia, Pa.

White Metal Rolling for the Trade.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Wilfley Tables.
Mine & Smelter Supply Co., New York.

Wire (See name of metal wanted).

Wire Coilers.
Baird Machine Co., Bridgeport, Conn.
Torrington Manufacturing Co., Torrington, Conn.

Wire Goods Manufacturers (See also Metal Goods made to order).
Autoyre Co., The, Oakville, Conn.
Baird Machine Co., Bridgeport, Conn.

Wire Mill Equipment.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Wire Nails, All Metals.
Hassall, John, Inc., Brooklyn, N. Y.

Wire Straightening and Forming Machinery.
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Shuster, The F. B., Co., New Haven, Conn.

Wire Wheel and Hand Brushes (See also Foundry Supplies).
Blumenthal, H., & Co., New York.
Gem Mfg. Co., N. S., Pittsburgh, Pa.
Hanson & Van Winkle Co., Newark, N. J.
Manufacturers Brush Co., Cleveland, O.
Paxson, J. W., Co., Philadelphia, Pa.

Zinc Battery Plates.
Matthiesen & Hegeler Zinc Co., La Salle, Ill.

Zinc, Cold Rolled, in Coil.
Platt Bros. Co., Waterbury, Conn.

Zinc Zyanide.
Apothecaries Hall Co., Waterbury, Conn.
Roessler & Hasslacher Chemical Co., New York.

Zinc, Dust (See also Platers' Supplies).
Cooper, Charles & Co., New York.
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
Leavitt, C. W., & Co., New York.
New Jersey Zinc Co., New York.
Roessler & Hasslacher Chemical Co., New York.
Seligman, Arthur, New York.
United States Smelting Co., Inc., New York.
Weil, Louis, New York.
Wenger & Co., Paul, New York.
Wiarda & Co., John C., Brooklyn, N. Y.

Zinc Salts, Commercial (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Buchanan, C. G., Chemical Co., Cincinnati, O.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Cooper, Charles, & Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Matthiesen & Hegeler Zinc Co., La Salle, Ill.
Wiarda & Co., John C., Brooklyn, N. Y.

Zinc, Sheets, Plates, Rods, Etc.
American Nickeloid Co., Peru, Ill.
Burns, E. R., Supply Co., Brooklyn, N. Y.
Illinois Zinc Co., Peru, Ill.
Matthiesen & Hegeler Zinc Co., La Salle, Ill.
National Sheet Metal Co., Peru, Ill.
Platt Bros. & Co., Waterbury, Conn.
Richards & Co., Boston, Mass.

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